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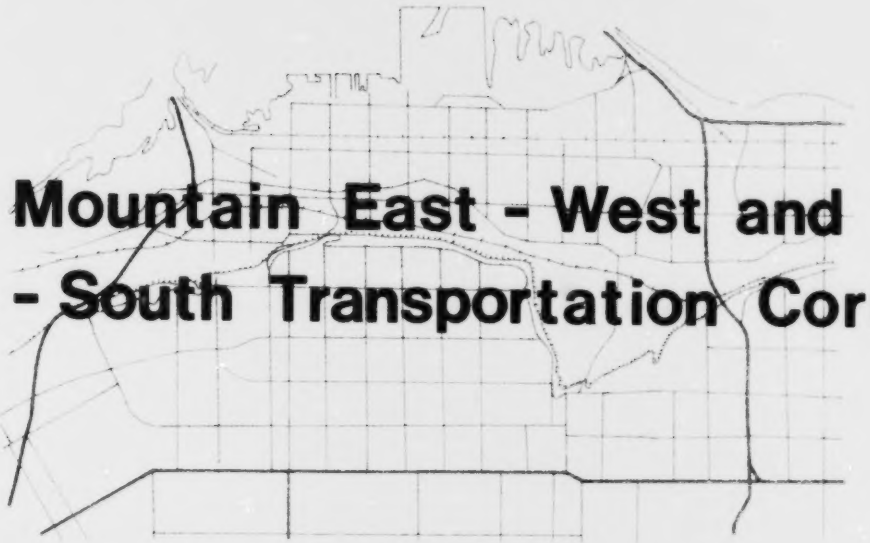

Mountain East - West and North - South Transportation Corridor

Volume I

ENVIRONMENTAL ASSESSMENT SUBMISSION

005486

December, 1982

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1. INTRODUCTION

This submission documents the findings and conclusions of a comprehensive investigation to identify the need, scope and timing for the expansion of the roadway network within the Regional Municipality of Hamilton-Wentworth. Based on the findings of the transportation analysis carried out as part of the Official Plan(1) preparation, the investigation focused on the upgrading of the roadway network connecting the road system south of the Niagara Escarpment to the major roadways located north of the Escarpment within the City of Hamilton and/or the Town of Stoney Creek.

1.1 THE ENVIRONMENTAL ASSESSMENT SUBMISSION

As this project was viewed to have potential for significant effects on the environment, an individual environmental assessment was deemed necessary to provide detailed consideration of the environmental factors. It represents a "one stage" submission process which includes the following major elements:

- presubmission consultation with the reviewing agencies;
- definitions of significant issues to be addressed in the investigation;
- one formal E.A. submission to provide the basis for approval to design and construct the undertaking; and
- the provision of informal secondary submissions as required to ensure the mitigative measures outlined in the formal submission are carried through to provide information for monitoring purposes.

In submitting this document, the proponent is seeking the following:

- concurrence that there is a transportation service deficiency which is detrimentally affecting the present social and economic environment in the Region,

- agreement that the identified deficiency cannot be better satisified by other modes, non-structural alternatives, or the upgrading of present roadways, compared to the proposed undertaking
- agreement that the selected roadway alternative satisfies the purpose of the undertaking and represents the most appropriate route;
- agreement that the impacts associated with the selected roadway alternative have been considered in sufficient detail such that subsequent design and construction considerations can be addressed through informal secondary submissions during those stages of the project;
- approval of the selected roadway alternative as indicated in Figures 28 through 50 contained in this submission; and
- approval to proceed with property acquisition for the required right-of-way, design and construction.

1.2 OBJECTIVE OF INVESTIGATION

Municipal government must be selective in carrying out major expansion of the present road network in order to make efficient use of available resources. However, elected officials are responsible for maintaining the vitality and well being of the community. Accessibility to current and planned development is a key factor in achieving this goal.

Based on the foregoing, the objective of this investigation was as follows:

- to assess the requirements for improved accessibility within the area to alleviate current transportation-related issues and to accommodate estimated travel demand resulting from the desired growth;
- to compare the options available and to select the most appropriate alternative;
- to indicate methods to minimize the adverse impacts and to reinforce the positive benefits of implementation; and

- to provide the public with the opportunity of commenting on the methods and results of the investigation.

1.3 THE STUDY AREA

The boundaries of the project study area are illustrated in Figure 1. The municipalities affected within the Region include the Town of Ancaster, the City of Hamilton, the Town of Stoney Creek, and the Township of Glanbrook.

The basis for the selection of this project study area included considerations of the constraints imposed by the extent of the present urban development. The rationale used in defining the study area is expanded upon in Section 5.1.3.

1.4 STUDY APPROACH

The study approach was developed in accordance with the intent of the environmental assessment process. It was a multi-step process which incorporated consideration of the effects on the natural, social and economic environments throughout the various stages of the investigation.

It entailed the collection of an extensive amount of relevant information from a variety of sources. These data were then supplemented and verified through discussions with participating agencies, interest groups and the general public, field surveys, and literature reviews.

Based on the estimates of roadway deficiencies, alternatives were evaluated in light of the degree to which they improved transportation accessibility and the impact on the social, natural and economic environments.

The evaluation process was, in effect, a process of elimination. It continued to narrow down the alternatives through the various stages of evaluation once reasonable grounds were identified for discarding a specific option. The potential to mitigate the adverse effects of each option were identified to assist in the evaluation process.

Importantly, the study approach included contact and consultation with the public throughout the investigation. Information brochures were distributed and public information centres were held to apprise the public of the study procedures, analysis and findings at each major point in the work program.

Further detail regarding the evaluation methodology and the public involvement program is contained in subsequent sections of this submission. The major phases of the project are briefly summarized below:

Phase 1 - Data Collection and Future Road Deficiencies

The initial phase focused on the estimation of current and future roadway deficiencies given the forecast of travel demand and the collection of relevant data on the environments potentially affected by roadway system expansion. The scope of the work included the following major activities:

- review and update the travel demand forecasts for both private and public transportation systems at selected development horizons;
- assemble and analyze available data related to existing and proposed community development, inventory the natural environment and identification of constraint areas, and the collection of information on the present economic environment;
- establish the location and magnitude of deficiencies related to the present roadway network considering increased useage of public transit; and
- organize a series of public information centres to outline the findings of Phase 1, the on-going work program, and to invite submissions regarding roadway expansion alternatives to be reviewed as part of Phase 2.

Phase 2 - Preliminary Evaluation of Alternatives

The intent of this phase was to identify and evaluate, in a preliminary manner, a number of reasonable alternatives including those generated by the public in order to select viable alternatives for more detailed analysis. The scope of the work involved the following activities:

- development of major roadway alternatives outlining the location, facility type for each segment, and the extent of the option;
- assignment of the projected vehicle volumes to each road network option to measure the degree to which each accommodated the forecast travel demand. An engineering analysis of each option was prepared to confirm the physical feasibility of each option and to develop construction cost and property estimates;
- preparation of a preliminary assessment of each alternative under each of the evaluation factors in sufficient detail and in a uniform manner to determine the implications for the regional road and transit system, the natural environment, the social/cultural environment and the economic/financial environment; and
- carry out a preliminary evaluation of each of the major alternatives to select those viable alternatives for further, more detailed analysis.

Phase 3 - Detailed Evaluation of Viable Alternatives

This phase involved the detailed examination and evaluation of the selected viable major alternatives in order to recommend a preferred alternative. The scope of the work involved the following activities:

- assignment of the vehicle volumes to the selected options to highlight possible differences;
- preparation of detailed plans and profiles at an appropriate scale in order to establish, with some degree of accuracy, their operational characteristics, construction and property costs;

- completion of a detailed impact assessment of each alternative under each evaluation factor;
- organization of a second series of drop-in centres, and also meetings with the public and organized interest groups in order to describe the viable alternatives selected for further analysis, the detailed evaluation methodology used to compare those alternatives, and an outline of the on-going work program; and
- evaluation of the selected alternatives and recommendation of a preferred alternative.

Phase 4 - The Selected Alternative

The intent of this phase was to detail the selected alternative in terms of its positive and negative impact and outline a suggested program of implementation. The scope of the work involved the following activities:

- completion of the preliminary design of the selected alternative in sufficient detail to permit detailing mitigative measures, the acquisition of right-of-way and to form the basis for future detailed design;
- integration of the selected roadway plan with the Recreational Master Plan developed specifically for the Red Hill Creek Valley;
- presentation of the final plans for both the roadway and the Recreational Master Plan for the Red Hill Creek Valley to the public through a third series of public information centres; and
- recommendation of an appropriate staging of implementation, considering travel demand requirements and the financial capabilities of the Region and Provincial agencies.

1.5 STUDY ORGANIZATION

The organization and direction of a large multi-disciplinary project requires the participation of a variety of professionals, representatives of affected agencies, and elected officials. The involvement was structured into three groups as follows:

Study Team:

A working group responsible for the day-to-day activities associated with this project was comprised of technical representatives of the Regional Departments of Engineering, Planning, and Public Transit, the area municipalities of Stoney Creek, Ancaster, and Hamilton, the Niagara Escarpment Commission, the Hamilton Region Conservation Authority, the Ministry of Transportation and Communications, and staff of the Consultant.

Steering Committee:

Because of the complexity and environmental sensitivity of the project, and also because of the considerable public interest, a Steering Committee was organized as a subcommittee of Regional Council. It included representatives of the elected and appointed officials of the Region, the affected municipalities, and the Ministry of Transportation and Communications. The Study Team, throughout the various phases of the study, periodically reported to this Steering Committee for progress and policy decisions.

The Steering Committee was officially dissolved at the end of Phase 3, once the most suitable alternative had been identified and approved by the Committee.

Municipal Councils:

Municipal Council members were continuously informed throughout the study phases by their Steering Committee representatives. Formal presentations were made to the affected Councils during Phase 3, following the public information centres held in May 1979. At these meetings, Council members were informed of the findings of Phases 1 and 2 and the detailed comparison of the alternatives investigated in Phase 3. They were requested to submit their comments and concerns about the six alternatives together with a preferred alternative through their representatives on Regional Council.

1.6 PROJECT HISTORY

The expansion of the roadway system east-west across the Mountain area, and north-south across the Escarpment in the east end of Hamilton, has been in the planning stage for several years. Past investigations include:

- a roadway planning report prepared by Parsons, Brinkerhoff, Hall and McDonald in 1957;
- the Hamilton Area Transportation Plan completed in 1963;
- the Hamilton Transportation Strategy Study completed jointly by the City of Hamilton and the IBI Group in 1973; and
- the Red Hill Creek Expressway Review completed in 1975 by the MTC.

In 1968, the east-west Mountain Freeway was incorporated into the Official Plan of the City as a principal feature of the road pattern and neighbourhood structure. During the early 1970's, the MTC and the City of Hamilton participated in the funding of property acquisitions within the designated corridor, 60 m in width, located immediately south of existing Limeridge Road.

In 1975, the transportation analysis carried out as part of the Official Regional Plan preparation indicated major road expansion in selected areas to support

the growth strategy adopted in the Official Plan (see ref. 1 - Map 6). Included in the proposed roadway facilities was a new roadway link connecting Highway 403 in Ancaster to the Queen Elizabeth Way in the eastern portions of the City of Hamilton. The Regional Official Plan was approved by the Minister of Housing June 26, 1980.

The investigation outlined in this submission is a further stage in the planning process. The project was initiated in February 1978. The submission of the reports for each of the initial three phases is summarized below.

Phase 1 - Future Road Needs and Data Collection[2], July 1978
Phase 2 - Preliminary Evaluation of Alternatives[3], January 1979
Phase 3 - Detailed Impact Assessment and Evaluation[4], August 1979

At the conclusion of Phase 3, a summary report[5] of the three previous phases was prepared and presented to Regional Council. At a special meeting of Regional Council on July 18, 1979, organizations and individuals were afforded an opportunity to voice their opinion directly to Council. In total, 32 briefs[6] were presented.

Subsequently, Regional Council adopted the recommendations of the Steering Committee and directed the Study Team to proceed with the following:

- the preparation of a functional planning report for the selected alternatives;

- development of a conceptual recreation master plan for the Red Hill Creek Valley compatible with the proposed roadway facility; and

- preparation of a submission to the Ministry of Environment in accordance with the requirements of the Environmental Assessment Act, 1975.

The functional planning document[7] detailing the refinement of the preferred alternative was submitted in September 1981. The report describing the

feasible development of the recreational resource of the Red Hill Creek Valley was prepared in parallel with the functional planning of the roadway. The recreation master plan document(8) was submitted in January 1982.

During the fall of 1981, the forecast of population and employment growth(9) within the Region of Hamilton-Wentworth was adjusted significantly. In addition, Regional Council rejected the introduction of a rapid transit link between the Mountain Urban Area and the core area. As a result, the forecast of transportation demand and related roadway deficiencies were revised to reflect these decisions. The updated travel demand forecasts were completed in July 1982(10).

The findings and conclusions derived from the preceding investigations were reappraised in light of the revised travel forecasts. The intent was to determine if the rationale for the undertaking remained valid. The conclusion of the reappraisal was affirmative and the decision was made by the Region to proceed with the Environmental Assessment submission incorporating the results of recent investigations.

1.7 GENERAL DESCRIPTION OF UNDERTAKING

The proposed roadway facility connects Highway 403 in Ancaster to the Queen Elizabeth Way in the eastern portion of the City of Hamilton. The roadway link is made up of two integrated facilities with a controlled access roadway in the north-south direction and a limited access arterial in the east-west direction. The proposed undertaking is illustrated in Figure 2.

2. STATEMENT OF RATIONALE

The conclusions of the investigation are set out in this section of the submission. The major findings resulting from the assessment of the alternatives to the undertaking and the alternative methods of carrying out the undertaking are given. The purpose of the undertaking is explained, together with the degree to which each alternative satisfies the stated purpose.

Based on the thorough and comprehensive investigation documented in this submission, the Regional Municipality of Hamilton-Wentworth is convinced the proposed undertaking represents the most desirable course of action. The potential benefits and negative effects of the proposal have been carefully weighed in reaching this conclusion.

2.1 PURPOSE OF THE UNDERTAKING

The purpose of the undertaking is a direct response to current local transportation issues expressed by the public, adopted policy of Regional Council, and the forecast of population and employment growth within the 20-year planning period to 2001. The underlying issues reflect current trends wherein road expansion may be rationalized as much on the environmental benefits as on purely traffic requirements.

2.1.1 Current Transportation-Related Issues

Level of Accessibility

The present roadway system crossing the Escarpment has reached 80 percent of its practical capacity. Within the central area of the Mountain, the access roads are approaching 95 percent of practical capacity. (Ref. 2 - Section 3.3)

The current low level of accessibility is cited as a contributing factor to the slow development of the designated residential and industrial lands south of the Escarpment. This conclusion is underlined by the report completed in 1978, entitled "An Action Plan for Economic Growth".(11) The report states:

> "Hamilton-Wentworth is not competitive with other geographical areas ... and is unlikely to become more so unless it obtains approvals and implements programs to service and develop industrial sites with easy highway access.
>
> "Nearly all of the serviced industrial sites which are vacant and available are on the Mountain. This area has poor transportation connections and is therefore unsuitable to be marketed as first-class industrial property."

The above conclusions were reiterated in the recently completed report entitled "An Industrial Land Development Strategy for Hamilton-Wentworth".(12) Nearly all business firms rely heavily on truck transport for delivery of raw material and distribution of manufactured goods. Secondly, distribution costs represent a major element of total business costs. In combination, good roadway access becomes a major factor in industrial location decision making.

Truck Route Network

Although the magnitude of the volumes represents less than 10 percent of the total traffic, heavy truck traffic contributes greatly to the basic traffic annoyance factors of excessive noise and air pollution. Within the urbanized area of Hamilton, the available truck routes are fronted by residential development for significant lengths, particularly by the arterial roads leading to the Escarpment accesses.

Continual complaints have been expressed by residents of Upper Ottawa Street, Mohawk Road, Kenilworth Avenue, and Centennial Parkway regarding noise, vibration, and pedestrian safety. During the past year, two tragic accidents have occurred at the base of the Claremont Access involving heavy trucks.

Within the present urban street network, the scope to limit the damage to the social environment created by truck traffic and to provide efficient routes for goods movement is clearly lacking. The potential to avoid using routes with high pedestrian or other traffic conflicts and steep gradients is very limited.

Safety of Vehicle Travel

The consequences of accidents consist of three major measurable elements of property damage, loss of earnings and/or work efforts, and health care. These have been estimated as at least the amounts given below:

ESTIMATED ACCIDENT COSTS: 1975*

Totals ($ billions)	
Property Damage	$1.4
Lost Work Efforts	$1.0
Health Care	$0.1
	$2.5

* Source: Ref. 13, Table 6.10, pp 51, The Future Role of the Automobile in Canada Transport Canada 1979

The total amount of $2.5 billion represents 15 percent of the total expenditure of road vehicle operation. Using the national relationship of property damage to total cost, the 1979[14] estimated costs of vehicle accidents in Hamilton-Wentworth totalled $30M. These statistics suggest more attention should be given to developing cost-effective measures to reduce vehicle accidents.

Accident rates are highly related to the degree of access control. In excess of 55 percent of all reportable accidents in Ontario occur at or are related to at-grade intersections. (See Ref. 14 - pp. 26) The rate of accidents on controlled-access facilities is 50 percent lower than other urban roadways.[15]

Traffic Nuisance in Residential Neighbourhoods

The environmental impact of traffic in terms of pedestrian safety, noise, and air quality is a major issue. As the level of congestion on the major roadways rises, corresponding increases in through traffic along residential streets have occurred. Besides negative effects on living amenities by virtue of increased traffic volumes, perceived economic impacts on property values are also a major concern. As volumes increase along residential streets, public awareness of the impacts increases proportionately.

Past Development Commitments

A number of developments south of the Escarpment have proceeded based on past commitments to the construction of a major roadway facility. These projects include:

- In Hamilton, a major east-west and north-south roadway facility was incorporated as a principal feature of the road pattern and the neighbourhood structure in the Mountain Urban Area. The OPA #228(16), 1968 also included a proposed industrial park in the east Mountain area, a regional shopping centre, and the downgrading of Limeridge Road from a major arterial.

  As a result, a right-of-way of 60 m in width was designated immediately south of Limeridge Road. Portions of Limeridge Road have been realigned and incorporated into the local street system. Of the 18 neighbourhoods abutting the designated right-of-way, 16 have approved neighbourhood plans. Specific development standards adopted in October 1973 to mitigate visual and noise disruption for properties immediately adjacent to the right-of-way have been imposed in many cases. The expansion of municipal services and utilities across the right-of-way have been positioned to avoid disruption during construction. The planned major commercial development located adjacent to the right-of-way at Upper Wentworth Street was opened in 1981.

- In Stoney Creek, the Saltfleet Community was premised on the construction of a major north-south freeway access along its western boundary. The present population of the community is approximately 5,800 residents, with a planned development population of 30,000. The Regional Council has restricted development of this area to 12,000 residents until such time as improved access is provided.

- In Ancaster, the Ontario Municipal Board on February 1, 1980 approved the development of approximately 2,000 acres bounded by Highway 53, Highway 403, and the western boundary of the City of Hamilton. The potential residential population of this development is 25,800 residents. The proposal indicated major expansion of the abutting road system would be required to accommodate the residential, commercial, and industrial uses. In March, 1982, the Regional Official Plan was modified and approved to reflect the OMB decision.

Energy Conservation

Road and traffic conditions have a significant effect on vehicle operating costs. As the level of congestion increases, the direct costs of operating autos and commercial vehicles rise dramatically. Auto fuel consumption at an average speed of 55 km/h is 50 percent lower than operation in low-speed traffic at 16 km/h. (See Ref. 13 - Appendix 4C)

The provision of an efficient transportation network to reduce travel costs is a positive response to current local, regional and national concern regarding energy conservation. It is a major benefit to residents and businesses within the Region.

2.1.2 Approved Regional Policy

A transportation master plan defines the roles of the different transportation systems and outlines the major improvements necessary to meet the transportation requirements and the development objectives over the next 20 years. In Hamilton-Wentworth, the Regional Official Plan, as adopted by Council and approved by the Ministry of Housing, provides direction on these matters.

Planned improvements are aimed at providing an integrated and coordinated transportation system which will meet expected changes in transportation technology and user attitudes, and will accommodate increases in demand related to planned development as well as provide a stimulus for development and economic growth.

The specific transportation policies of Regional Council related to this undertaking as given in the Regional Official Plan are outlined below.

"It should be the general policy of Regional Council:

- To provide new transportation facilities and services or upgrade existing facilities and services where they are deemed necessary to support development plans that are consistent with the Official Plan policies, and where the existing facility or service is under the jurisdiction of the Region or where the new facility or service meets established criteria to define it as a Regional responsibility.

- That public transit receive a high priority in the planning of new transportation facilities in the urban area. Transit solutions to transportation access and capacity problems will be integrated with improvements to the road system.

- To protect any rights-of-way which may become available until an evaluation is made of their potential as a component of the Regional transportation system."

- "That the road system shown on Map No. 6 be adopted as the framework for planning and designing the road system necessary to support the land use plan as outlined in the Official Plans of the Region and Area Municipalities. The

road system shall be upgraded progressively throughout the planning period to accommodate the transportation demands associated with the development pattern."

Source: Regional Official Plan pp 67

- "To take immediate action to protect the specified road right-of-way widths on the Regional roads through the adoption of appropriate bylaws. The Area Municipalities and the Province shall be encouraged to take similar action to protect those roads covered under the policies of this Plan but not under the jurisdiction of the Region."

Source: Regional Official Plan pp 70

"To make major improvements in the road system over the planning period. To overcome existing and forecasted deficiencies in the arterial road network, such improvements will include the following new road connections:

b) A new east-west roadway on the Hamilton Mountain connecting from Highway 403 in the west to a new north-south arterial road in the east as designated in Map No. 6;

c) A new north-south road, crossing the Niagara Escarpment along the Red Hill Creek Valley connecting the new east-west roadway in the south to the Queen Elizabeth Way in the north as designated in Map No. 6;

f) Additional north-south road capacity across the Niagara Escarpment in the central Hamilton corridor between Becketts Drive and the Sherman access to be restricted to improvements to the approaches of the existing access routes."

Source: Regional Official Plan pp 71

- "To protect lands for full controlled access interchanges with the proposed east-west roadway where the road crosses: Garth St., Upper James St., Upper Wentworth St., Upper Gage Avenue and the northern extension of Dartnall Avenue. The exact boundaries of the lands required for these interchanges shall be designated in Secondary Plans."

Source: Regional Official Plan pp 72

- "To maintain an efficient system of designated truck routes throughout the Region, utilizing portions of the arterial road system. This system shall be reviewed on a regular basis to

minimize the intrusion of trucks into residential areas while providing an acceptable level of service to industrial and commercial development in the Region."

Source: Regional Official Plan pp 74

"That the urban transit system in the Region be planned and operated in such a manner that:

a) Downtown Hamilton be the primary focal point of transit service and the level of service into the downtown area will be such that it will provide a degree of accessibility that is consistent with the downtown's role as a Regional Centre and will reduce the need for the operation of private automobiles into the downtown area."

Source: Regional Official Plan pp 76

2.1.3 Increase in Travel Demand

Within the 2001 planning period, the forecast of population growth is relatively modest for the Region in total. The current population is 410,500 residents and the 2001 forecast totals 445,000. However, the redistribution of population will create significant growth in the urban area south of the Escarpment bounded by Limeridge Road, Highway 403, Highway 53, and Highway 20.

This forecast is consistent with past trends. Since 1960, the population of this area has grown from 79,500 in 1960 to 129,300 in 1980; an increase of 62 percent. In comparison, the Regional population increased 18 percent. In the next 20 years, the population of this area is forecast to increase to 177,000, or 33 percent. The expansion of employment is expected to remain concentrated principally within the present major employment centres located north of the Escarpment. In excess of 55 percent of the total employment within the Region is focused on the Hamilton Central Business District, the Bay Front industrial complex, McMaster University, and the Stoney Creek Industrial Park. It is expected these major activity centres will be reinforced. The core area will continue to be the major activity centre in the Region.

The growth in travel demand crossing the Escarpment is forecast to increase 65 percent by 2001. Despite optimistic assumptions related to the future use of public transit, the projected 2001 roadway deficiency is equivalent to 4 arterial lanes in one direction. If the assumed higher transit ridership is not achieved, the deficiency could increase to the equivalent of 6 arterial lanes.

2.1.4 Summary Statement

Based on the preceding, the purpose of the undertaking is to provide a response to current transportation-related issues, to fulfill approved Council policies on transportation as outlined in the Official Plan, and to adequately accommodate future increases in travel demand as growth takes place.

The specific goals of the undertaking include:

- to provide an acceptable level of transportation service recognizing aspects of safety, energy efficiency, and operating costs;
- to develop an improved truck route network within the Region;
- to reduce traffic nuisance in established and proposed residential areas;
- to provide a catalyst to promote development in accordance with the Official Plan;
- to minimize the adverse effects of increases in transportation demand as growth takes place; and
- to reinforce the desired balance between the use of public and private transportation.

The justification of proceeding to provide a solution to the problem is clear. Without expansion of the transportation system serving the area south of the

Escarpment, the designated growth pattern contained in the adopted Regional Official Plan will be severely retarded. The past commitments in planning and infrastructure will not be fully utilized.

2.2 THE APPROPRIATE PLANNING ALTERNATIVE

Several planning strategies were assessed as possible ways of achieving the stated purpose of the undertaking. These options included:

- the relief of the projected transportation deficiencies provided by other planned road improvements;
- the greater use of public transit;
- non-structural methods such as staggered work hours, increased vehicle occupancy and shifting of non-work travel from the peak hour;
- traffic operational improvements;
- expansion of existing roadways; and
- the construction of new roadways.

The above strategies were grouped into three basic planning alternatives, namely the NO-ACTION alternative, the MINOR alternative and the MAJOR road expansion alternative.

2.2.1 NO-ACTION Alternative

The NO-ACTION alternative is defined as the continued maintenance of present road facilities in combination with the planned expansion of the road system within available rights-of-way. The influence of other strategies were examined including:

- increased public transit use
- various non-structural methods of reducing peak hour traffic
- the impact of other planned roadway projects.

The possible impact of increased transit use and non-structural methods to alter travel habits have been considered in the vehicle demand estimates. It would be unreasonable to assume any further reductions in vehicle volumes due to the influence of these factors.

A 50 percent increase in the per capita rate of transit use has been assumed possible by 2001. This target is optimistic but achievable. Accordingly, the forecasts of travel demand are considered to provide a sound basis upon which to predict deficiencies in the road system under the projected 2001 development.

The effect of other road projects in reducing the forecast deficiency is limited. They are neither located or designed to relieve the internal traffic deficiency crossing the Escarpment. The analysis carried out ensured the possible influence of these road projects was reflected in the forecast road deficiencies.

2.2.2 The MINOR Alternative

The MINOR alternative was defined as including the following:

- the influence of the measures considered under the NO-ACTION alternative
- operational modifications to the road system such as preferential lanes, traffic control, selective lane additions and intersection improvements
- road projects without significant environmental impact.

Maximum advantage has been taken of operational improvements particularly to the Escarpment accesses to expand the road system capacity to its practical limit. Further expansion of capacity cannot be achieved without widening of the present roadways crossing the Escarpment.

The reasonable projects which would have an impact on the traffic capacity include:

- the James Street/Arkledun Avenue/St. Joseph's Drive improvement
- the widening of Highway 20 from 4 lanes to 6 lanes.

The total cost of the above improvements was estimated to be $8.7M (1979). Despite these improvements, a significant 2001 roadway capacity deficiency would remain.

2.2.3 MAJOR Road Expansion Alternatives

The collection and analysis of relevant data related to the existing and planned development, the natural environment constraint areas, and present infrastructure formed the initial framework for identifying an appropriate geographical area to develop MAJOR ROAD EXPANSION alternatives. The geographical area must allow for the development of a continuous road connection between Highway 403 and the QEW. The east-west and north-south roadway sections complement each other.

The examination of possible alignments in the north-south direction focused on the area between the Kenilworth Access and Fruitland Road. Five alternative corridors were selected as follows:

- Kenilworth Corridor
- Red Hill Creek Valley
- Highway 20 Corridor
- Highway 20/Red Hill Creek Valley combination
- Fruitland Road Corridor

In the east-west direction, three possible corridors were identified:

- Existing Arterial Street Network (Limeridge Road)
- Limeridge Road Corridor
- Hydro Right-of-Way

Taking into account the various reasonable combinations of corridor and facility options, 15 alternatives were developed. In sizing the MAJOR road expansion alternatives, the James Street/Arkeldun Avenue/St. Joseph's Drive improvement was assumed in place to reduce the scale of new construction. The possible widening of Highway 20 was incorporated where required as part of the MAJOR road expansion alternative.

2.2.4 Assessment of Planning Alternatives

With reference to the stated purpose of the undertaking, the NO-ACTION alternative does not represent a realistic or acceptable solution. Maximum advantage has been taken of methods to optimize the capacity of the present system. The influence of the increased transit ridership or potential changes in travel characteristics will not be sufficient to offset the increase in travel demand generated by the forecast development of the Region.

The predicted 2001 equivalent deficiency of four arterial lanes crossing the Escarpment in the peak direction is significant. The estimate supports the conclusion that unless major road improvements are provided, no significant growth will occur on the Mountain due to the poor accessibility which would be provided by the present road system.

In addition, the NO-ACTION alternative would not be responsive to the present environmental issues related to:

- reducing the traffic nuisance aspects of noise and air pollution of automobile traffic and truck movements in existing residential areas;

- improving the efficiency and safety of goods movement within and through the urban area; and

- providing an impetus to approved development through greater accessibility to designated industrial areas and activity centres.

The MINOR alternative does not represent a reasonable alternative in terms of the degree to which it satisfies the purpose of the undertaking. The total cost for the limited expansion of the north-south road capacity is significant. It would increase the traffic nuisance aspects of noise and air pollution along Centennial Parkway and do little to minimize these effects along Mohawk Road and Upper Ottawa Street. Congestion levels would create a deterrent to development of the residential and industrial areas south of the Escarpment. The efficiency of urban goods movement would further deteriorate.

In effect, the MINOR alternative would only prolong the requirement for major road expansion to support the desired development. Meanwhile, the present disruptive effects of traffic within residential areas would increase without any enhancement of planned development. The widening of Centennial Parkway (Highway 20) will further aggrevate current social issues related to noise and safety. In the past, residents along Centennial Parkway have strongly opposed any roadway widening proposals.

The evaluation of the above strategies resulted in the selection of new roadway construction as the appropriate planning alternative. If development as outlined in the Official Plan is to take place and current transportation deficiencies are to be resolved, construction of a major new roadway represents the most appropriate transportation planning alternative.

2.3 EVALUATION OF MAJOR ROADWAY EXPANSION ALTERNATIVES

The comparison of the 15 major road expansion alternatives was structured in two parts: a preliminary screening and a detailed impact assessment. At each stage, the assessment factors considered basic concerns expressed by the public related to:

- transportation service;
- social environment;
- natural environment; and
- cost.

The assessment was expanded depending on the level of detail required to eliminate various alternatives from futher consideration. The process screened out those alternatives which failed to meet acceptable standards or which did not accommodate the projected travel demand while creating significant impacts on the environment. All reasonable and viable alternatives were considered in the selection of the preferred roadway expansion option.

The preferred alternative was selected as it was the least disruptive to the community and provided the best opportunity to achieve the desirable objectives for growth and development in the Region. Opportunities exist to mitigate some of the undesirable effects of construction particularly in the Red Hill Creek Valley. Significant additional costs over and above normal construction have been incorporated to assist in maintaining the social and environmental standards demanded by the public. These elements include:

- extensive noise attentuation structures;
- landscaping and screening of the roadway from adjacent development; and
- integration with a possible recreation facility development in the Red Hill Creek Valley.

2.4 DESCRIPTION OF THE RECOMMENDED ROADWAY

The alignment, profile and relationship of the recommended roadway to the surrounding development is detailed in Figures 28 to 50. The plan illustrates the ultimate development within the designated right-of-way. The estimated capital cost totals $123,915,000 (1982) including property costs.

The staging of construction recognizes traffic and development priorities, construction sequence requirements, and the financial capabilities of the funding agencies. The initial construction would be based on the projected 2001 traffic forecasts. All grading and structures would be completed to the ultimate requirements to minimize disruption to the natural and social environments.

The project is envisaged to be carried out on a continuous basis starting in 1985. The initial construction within the designated right-of-way can be completed by 1995. The priority staging within the 10 year period is outlined below.

Stage 1 - Upper Gage to King Street
Stage 2 - King Street to the Queen Elizabeth Way
Stage 3 - Upper Gage Avenue Highway 403

At each stage, the completed facility would be integrated with the adjacent arterial street system.

2.5 RESPONSE TO ISSUES

Extensive investigations related to utility relocation, soils, drainage, and roadway functional planning confirmed the feasibility of constructing the facility using conventional techniques. In addition, further analysis was completed related to noise impact, recreation resources, and the natural environment to successfully respond to public concerns.

2.5.1 Social Impacts

The impact on the residents living near or adjacent to the proposed roadway facility will be minimal or limited. The selected location follows currently established community boundaries. The proposed roadway was incorporated as a principal planning feature in the structuring of the neighbourhoods in the

Mountain Urban Area. In the north-south corridor, the roadway is contained principally within public open space and, therefore, the form of adjacent residential areas is not affected. The internal roadway system within the Vincent/Red Hill Community was developed predicated on the existence of a major roadway within the Red Hill Creek Valley.

Accessibility to local and neighbourhood facilities is not altered. In general, full access to the proposed facility and to the existing collector and arterial street system is maintained. The change in local traffic circulation patterns is minimal. Being located along neighbourhood boundaries, the effect on pedestrian movements to local educational, religious and recreational facilities is not adverse.

Given the scale of the roadway project, the displacement of people through residential property acquisition is relatively small. In the east-west corridor, 25 homes would be required for the initial construction. In the north-south corridor, 4 homes will be displaced due to the proposed roadway construction. The impact of displacement will be greatly reduced due to the availability of replacement housing being high and the extended time for relocation of 5 to 10 years being available.

No change in the air quality in the residential neighbourhoods adjacent to the proposed roadway is projected. A detailed analysis suggests the magnitude of the change is small and restricted within the roadway right-of-way. However, air quality conditions will improve along parallel roadways due to the reduction in traffic.

An in-depth noise impact analysis confirmed the planned acoustical barriers incorporated in the construction will be capable of maintaining noise levels within acceptable limits. The 24-hour ambient noise levels within the adjacent residential neighbourhoods will not exceed 60 dBA under the proposal. This noise level is consistent with the ambient noise level in a fully developed urbanized area and within Provincial guidelines.

The archaeological and historic sites investigation indicates the proposed corridors have been extensively disturbed by past development and cultivation. No archaeological sites of scientific or educational value exist along the route. Of the limited number of historic structures identified, preservation through relocation is possible if deemed warranted.

The construction of the proposed roadway within the Red Hill Creek Valley will have a minor impact on existing recreational facilities. The recreational master planning analysis indicates that the potential of the King's Forest Park area for active and passive recreation can be achieved. North of the T.H.& B. Railway crossing, the use of the Valley would be restricted to pedestrian linkages similar to its present use. Accordingly, the impact of the proposed roadway construction on the recreational resource is considered moderate.

In all segments of the proposed roadway corridors, the natural scenic resource has been disturbed to a greater or lesser degree by the present and past surrounding urban development. In the area of the Upper Red Hill Creek Valley, the impact of the roadway construction on the urban scenic resource of the Niagara Escarpment could be significant. Mitigation of the impact has been provided by:

- restriction of the roadway to the east side of the Valley adjacent to the HEPC tower transmission line and the existing Mount Albion Road crossing of the Niagara Escarpment;
- the provision of earth berms and vegetation buffers; and
- maintenance of current pedestrian access from the residential areas to the Valley.

In other sections of the roadway alignment, the impact of the roadway construction on scenic resources is considered moderate.

2.5.2 Economic Impacts

The economic impact of a transportation facility is measured by changes in employment, property values, income and business activity. Direct economic

impact includes displacement as well as the generation of jobs and income through the purchase of goods and services to construct the roadway. Indirect economic effects include induced changes in growth, accessibility to markets, and possible effects on adjacent property values.

The magnitude of direct economic impact is positive since no existing business would be affected and considerable employment due to construction would be created. No detrimental indirect effect on local business is forecast as neighbourhood accessibility is maintained and diversion of traffic is not foreseen as a major impact since through traffic volumes on the facility represent less than 10 percent of the total. Consequently, the effect on highway commercial business is expected to be minimal.

In general, the construction of the roadway is viewed as a positive factor in achieving the planned growth of the employment and residential areas within the Region. The proposed facility will upgrade the current level of accessibility under the planned growth of the Region. The efficient movement of goods and services is being affected by the current lack of attractive transportation routes. This results in a decline of the competitive advantage of the established and planned industrial and commercial development within the Region.

Estimating property value changes and induced-growth effects is difficult. Where property values have increased, improved accessibility has been cited as the primary reason. Losses in property values are most frequently attributed to decrease in accessibility and increases in noise and air pollution. Based on the above, property values adjacent to the facility will not be adversely affected. Current accessibility levels have been maintained or improved while the analyses of air quality and noise levels suggest current conditions can be maintained or kept within the perceived acceptable standards within an urban environment.

Definite positive fiscal and social effects will accrue due to the construction of the proposed transportation facility. These effects relate directly to the diversion of through auto and truck volumes from adjacent streets with

abutting residential development. The air and noise pollution from this traffic can depress residential property values and commercial activity. The right-of-way provided under the proposed roadway is sufficient to develop noise and visual protection of the abutting residential areas. Little or no protection can be offered under the existing road system because rights-of-way and the access requirements do not provide an opportunity to protect the abutting properties from the noise and visual intrusion.

2.5.3 Resources and Energy

The proposed facility does not support the continued current rate of use of the automobile, but recognizes a balance in the use of the public and private transportation modes. The projected vehicle demands generated by the planned growth reflect the provision of an improved and expanded public transit system.

The energy required to operate the projected volume of traffic under the improved roadway system will be reduced compared to the present roadway system. As a result, the construction of the proposed roadway is a positive approach to reducing energy consumption. The reduction in fuel consumption will result in cost savings to local residents.

2.5.4 Natural Environment

Based on the analysis undertaken, adjustments in the roadway alignment were carried out to minimize the disturbance of the terrestrial and aquatic ecosystems. These adjustments principally involved avoidance of major woodlots or their significant fragmentation. Fourteen areas of concern relative to the natural environment were identified at the microscale. As a result of the interactive process, five of the features have been completely avoided. Of the remaining areas, the impact on all but two of the features is considered moderate and capable of successful mitigation.

At the Upper Ottawa Street Landfill Site, the roadway alignment will cause fragmentation of the existing woodlot. A minor stream diversion is planned for the Red Hill Creek in this location. As the wildlife is principally avian and urban tolerant, the impact of the roadway construction is considered moderate.

The impact on the Red Hill Creek Marsh will be severe and difficult to mitigate. In assessing the significance, the impact must be viewed in relation to the existence and planned expansion of the Queen Elizabeth Way between Burlington Street and Highway 20. The Marsh area is presently highly disturbed as a result of being adjacent to the Queen Elizabeth Way and the past construction of the Hydro transmission towers and the CNR spur line to Lang's Foods.

2.5.5 Summary Statement

In summary, the need for the selected roadway alternative has been established through a comprehensive assessment of the advantages and disadvantages to the total environment. Clearly, the No-Action or the limited expansion of the present roadway system alternative are not capable of meeting the purpose of the undertaking. This has been demonstrated despite optimistic assumptions regarding possible future changes in travel characteristics which might reduce the dependence on the private auto.

Some growth will occur regardless of the decision to proceed with the improvement to the transportation system. As congestion on the road system increases, the issues associated with fuel consumption, truck traffic, safety, and the impact on established residential areas will magnify proportionately.

The time required to design and construct a roadway facility of the magnitude contemplated requires significant lead time, likely in the order of five years. Therefore, seeking approval to proceed with the design and construction of the undertaking at this time is appropriate.

3. FORECAST OF TRANSPORTATION DEMAND

This section outlines the basis for the projection of the future roadway requirements within the selected area of investigation. The projection is developed sequentially through a discussion of the following:

i) the multi-modal aspects of urban transportation;

ii) the selected growth strategy for the Region, both within the planning period to 2001 and the designated long-term development capability;

iii) the present travel characteristics within the area of investigation, including the analysis of the Escarpment road accesses, the public transit service, and the distribution of truck traffic;

iv) the forecast of travel demand in terms of person-trips and the basis for the allocation of these trips between the road network and the public transit system; and

v) the resultant location and sizing of the roadway system deficiencies within the selected area of investigation.

3.1 GENERAL DISCUSSION OF MULTI-MODAL ASPECTS OF URBAN TRANSPORTATION

Transportation planning, in the most basic sense, is focused on the improvement of access and/or maintaining an acceptable level of accessibility under conditions of increased travel demand. Improved accessibility is the direct result which the expansion of transportation systems accomplishes. The indirect benefits are significant and include the following:

- allowing development to take place in the desired form
- enhancing the attractiveness of employment areas
- reducing travel time and thereby minimizing fuel consumption for both private, public and commercial vehicles
- improving safety for both drivers, passengers and pedestrians

- improving living amenities by reduced through traffic in residential areas

Travel demand analysis recognizes transportation as a derived demand. Transportation is primarily determined by the activities at the beginning and the end of the trip. As such, the magnitude and distribution of travel within an urban area is determined directly from the present and planned spatial arrangement of population and employment.

The challenge in transportation planning focuses on maintaining an acceptable level of mobility to accommodate growth while protecting or enhancing the living amenities, heritage resources and the natural enviroment. In addition, a new criterion of increasing importance is maximizing energy conservation.

An effective transportation plan must recognize the capabilities of the private and public modes of transportation to efficiently handle travel demand. In addition, the movement of goods must be accommodated. The multi-modal transportation plan strikes a workable balance between private and public modes and utilizes these modes where they can be effective and efficient.

The type and intensity of development is the major determinant of the suitability of the individual transportation mode. Public transportation is most effective when accommodating defined corridor demands focused on a major activity centre. Private transportation is best suited to handle more dispersed segment of travel demand between residential areas and non-core area activity centres. As such, the two modes are complementary rather than competitive in providing the desirable level of accessibility within an urban area.

The forecast of the future roadway requirements outlined in the remainder of this section recognizes the multi-modal aspects of the Regional transportation system. The assumed increased use of public transit and the assumed acceptable roadway level of service standard support the Region's objective of encouraging greater use of public transit.

3.2 PLANNED REGIONAL DEVELOPMENT

The major urbanized areas within the Region are located within the City of Hamilton, Town of Dundas, Town of Ancaster and Town of Stoney Creek. The limits of the urbanized area, together with the boundaries of the six local municipalities are illustrated in Figure 3. In excess of 90 percent of the total population is contained within the urbanized areas illustrated.

Employment opportunities within the Region are concentrated. In excess of 55 percent of the total employment within the Region is focused in the Hamilton Central Business District, the Bay Front industrial complex, the McMaster University area and the Stoney Creek Industrial Park. The Regional Official Plan foresees a general continuation of current development trends.

The growth in population and employment derived from "Hamilton-Wentworth Population Projections 1981 Review" is highlighted in Figure 4. The major growth in population will be concentrated in the following areas:

- the urban area of Stoney Creek located below the Escarpment easterly to Fruitland Road;
- the urban area of Stoney Creek located above the Escarpment bounded by the east limits of Hamilton, Highway 53 and Highway 20;
- the urban area of Hamilton located south of Limeridge Road; and
- the urban area of Ancaster located south of the Escarpment bounded by the west limits of Hamilton, Highway 53 and Highway 403.

Similar to the population distribution, the expansion of employment will remain concentrated within the present major employment centres, the Mountain Sub-Regional Centre, the Mountain Industrial Park, the Stoney Creek Industrial Park, the Highway 53 Industrial Park and the Mohawk/403 Industrial Park in Ancaster. It is expected that the present major activity centres will be reinforced. The Central Business District of Hamilton will continue to be the major activity centre in the Region. Expansion and redevelopment is continuing within this area.

The projected population within the period to 2001, and the potential capability for development designated in the Official Plan are summarized in Table 3.1. Corresponding projections of employment are given in Table 3.2.

The implications of the planned Regional development forecast on travel demand are significant. Within the 2001 planning period, the rate of population growth is relatively modest for the Region in total. However, the redistribution of population will create significant growth in the urban area south of the Escarpment in the area bounded by Limeridge Road, Highway 403, Highway 53 and Highway 20, hereafter designated as the Mountain Urban Area.

The current population in this area totals 129,300. The 2001 forecast predicts 177,000 residents in this area; a 36.9 percent increase. This projection is consistent with past and current trends as highlighted in the following tabulation:

Year	Mountain Urban Area	Hamilton Population	Regional Population
1960	79,500	263,700	348,200
1965	99,200	283,100	383,200
1971	117,000	304,100	391,800
1976	124,500	310,600	409,800
1980	129,300	306,800	410,500
2001	177,000	302,200	445,000
Designated Development Capability	216,700	367,300	550,000

Source: Regional Planning Department

The population given under the heading "Designated Development Capability" is an estimate of the possible population potential of the areas designated for development in the Official Plan.

Table 3.1

PROJECTED POPULATION GROWTH

Municipality	1980	2001	Designated Development Capability
Ancaster	14,400	31,500	38,000
Dundas	19,500	20,000	25,000
Flamborough	24,200	29,500	30,000
Glanbrook	9,700	9,000	14,600
Hamilton			
- Lower City	195,900	171,200	216,800
- Mountain	110,900	130,800	150,200
	306,800	302,000	367,000
Stoney Creek			
- Lower Town	28,100	34,700	42,900
- Mountain	7,800	18,300	32,500
	35,900	52,600	75,400
TOTAL	410,500	445,000	550,000

Source: Regional Planning Department

Table 3.2

PROJECTED EMPLOYMENT GROWTH

Municipality	1971	2001	Designated Development Capability
Ancaster	2,000	9,400	12,000
Dundas	4,600	5,500	6,600
Flamborough	3,400	5,600	6,500
Glanbrook	1,500	3,300	7,000
Hamilton			
- Core Area	30,100	49,900	67,800
- Bay Front	46,800	48,900	54,600
- McMaster	5,800	7,300	10,200
- Sub-Regional Centre	200	3,300	4,400
- Mountain Industrial Park	300	4,900	7,400
- Other	51,700	65,400	84,500
Subtotal	134,900	179,700	228,900
Stoney Creek			
- Industrial Park	2,000	12,100	12,900
- Other	4,800	12,300	16,100
Subtotal	6,800	24,300	29,000
TOTAL	153,200	227,800	290,000

Source: Regional Planning Department

The annual average population growth rate of this area during the past 20 years has averaged 2.5 percent. In the past five years, the growth rate has been approximately 1.0 percent annually. The forecast annual rate of growth is approximately 1.5 percent.

Given the continuous focus of employment north of the Escarpment, combined with the major residential growth south of the Escarpment, a significant increase in peak hour traffic can be expected across the Escarpment. This, again is consistent with past experience. The growth of the population south of the Escarpment created the pressure to expand the roadways crossing the Escarpment. In the past 20 years, major improvements have been implemented, including:

- widening of the Jolley Cut;
- construction of Highway 403;
- construction of the Claremont Access; and
- the introduction of peak hour contra flow lanes on the Sherman Cut and James Mountain Road.

The foregoing provided direction in the selection of the appropriate area on which to focus the investigation of future roadway requirements. Clearly, the growth in travel demand will focus on the roadway system crossing the Escarpment due to the residential growth above the Escarpment and the focus of employment and major activity being expanded and reinforced north of the Escarpment. Accordingly, the assessment of future transportation requirements was narrowed to an area of investigation comprised of the City of Hamilton, the easterly portion of Ancaster and the westerly portion of Stoney Creek bounded by Fruitland Road.

3.3 PRESENT TRANSPORTATION SYSTEM: MOUNTAIN URBAN AREA

The analysis of the planned Regional development indicated that travel demand growth will be focused on the network of roads and public transit routes crossing the Escarpment.

3.3.1 Description of Escarpment Road Accesses

The Niagara Escarpment has and will continue to pose a major physical barrier to providing easily attainable access between the Mountain Urban Area and the Lower City. The roadways crossing the Escarpment were grouped into three screenlines to provide an improved basis for analysis for the following reasons:

i) because of parallel facilities, there are a number of alternative routes available and the choice between routes can vary from the most direct route in order to reduce travel time and/or local congestion;

ii) comparison of historical trends must be based on roadway groupings as present roadways are expanded or new parallel roadways are added; and

iii) the traffic characteristics, i.e., local vs through traffic and modal split varies due to the type and the location of the roadway facility and the transit services.

The roadway(s) included in each grouping are listed below:

Screenline	Roadways
West	Wilson Street
	Highway 403
Central	Beckett Drive
	James Mountain Road
	Claremont Access
	Jolley Cut
	Sherman Cut
	Kenilworth Access
East	Mount Albion Road
	Highway 20

Highway 403 and Highway 20, as well providing major links in the area provincial system, constitute major commuter routes between the Lower City and the Mountain. These routes have and will continue to function as significant links in the urban transportation system.

The physical and operating characteristics of each access are summarized by screenline in Figures 5 and 6. The traffic volumes and number of lanes are given.

The analysis of the traffic-carrying capacity of the present Escarpment crossings respresents a critical component in the determination of present and future deficiencies. The criterion selected for this analysis is the point at which the roadway carrying capacity reaches a practical maximum during a 60-minute period.

The estimation of the vehicle-carrying capacity of an urban arterial street cannot be isolated from the remainder of the overall system. Because they operate as a total network, the capacity of specific roadway sections may

limit the total capacity of the area network. In general, the capacity of the signalized intersection usually governs the capacity of the arterials leading to and beyond the intersection. Because of this, the analysis has focused on the capacity of the signalized intersections. In some instances, the characteristics of the roadway beyond the intersection control the capacity due to a possible combination of alignment and/or grade.

The principal reference used in the capacity analysis were those procedures outlined in the MTC Method of Signalized Intersection Capacity.(17) Field checks were carried out to verify the estimates and a reasonably good relationship was found between the estimates and actual field counts. The findings have been reviewed with the Hamilton Department of Traffic to take advantage of local experience. In some cases, the capacity estimates were adjusted to account for localized effects on lane utilization.

The principal findings are as follows:

- **the present roadway network crossing the Escarpment is approaching the available capacity. This varies according to each screenline. The West Screenline (Highway 403) is operating at approximately 45 percent of its capacity. The central Mountain accesses (Central Screenline) are approaching 95 percent of the available capacity. The easterly screenline comprised of Mount Albion Road and Highway 20 (East Screenline) is operating at 75 percent of its capacity.**

- **the potential to reasonably expand the capacity of these roadways is extremely limited. Maximum advantage has been taken of traffic operational improvements to increase the traffic-carrying capability of these roadways, including one-way operation and reverse flow strategies. The capacity of the accesses is in balance with the capacity of the street network located upstream and downstream of the Escarpment crossings. Any significant expansion of capacity must include expansion of the street network leading to and away from these crossings. The physical limitations on all accesses virtually preclude any reasonable consideration of widening of these roadways.**

3.3.2 Present Transit Services

The Hamilton Street Railway (HSR) operates a fixed route, surface public transit service. The fleet of vehicles is comprised of both diesel transit buses and electric trolley buses.

The public transit routes serving the Mountain Urban Area are illustrated in Figure 7. The routing system is focused on the core area of Hamilton, supplemented by east-west routes to provide for local transit trips. The majority of the service crosses the Escarpment using the Jolley Cut, with secondary routes operating on Beckett Drive, the Claremont Access, the Kenilworth Access and Mount Albion Road.

The level of service provided compares favourably with other communities. The hours of service, frequency of operation and accessibility is consistent with the demand.

In 1981, the Region of Hamilton-Wentworth completed a major feasibility study on the merits of a rapid transit line between the core area of the City and the Mountain. As the implementation of the proposal was rejected by Regional Council in December, 1981, the demand for public transit services will be met by a conventional bus system within the planning period to 2001. Future expansion of the transit system will be through the extension of present surface transit routes along the arterial street grid.

In summary, the level of public transit service and the corresponding ridership is consistent with the experience of other municipalities. The introduction of higher speed, separate right-of-way transit to serve this area has been deferred.

3.3.3 Distribution of Truck Traffic

Urban goods movement reflects the diverse needs of many establishments within an urban area. Although relatively little information exists for the

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total urban goods movement within the Hamilton-Wentworth Region, considerable information is available on urban truck travel.

Most truck travel is confined within the 12-hour period from 6:00 a.m. to 6:00 p.m. with the majority concentrated in the 7-hour period from 9:00 a.m. to 4:00 p.m. In 1972, an origin-destination survey was completed. The data is summarized in Table 3.3. For the internal screenline crossings located along the east-west Escarpment, north-south along Victoria Avenue between the Escarpment and the Bay Front, and north-south along Kenilworth Avenue, it was found that approximately 98 percent of the truck volume was either local or destined traffic. This is explained by the industrial nature of Hamilton's downtown and Lower City area. Many central depots and distribution warehouses are located in this district.

Of importance, Sherman Avenue is the approximate division for trips destined north and northeast, generally the greater Toronto area. In other words, trips destined or originating east of Sherman Avenue use the Skyway Bridge, while trips starting or ending west of Sherman Avenue use Highway 403.

The two most significant roadway links for through truck movement consist of the Highways 2, 53, 20 and Queen Elizabeth Way link, and the Highway 6 - Upper James Street - Mohawk Road and Highway 403 link. A significant proportion of trucks leaving the east end of the City originate east of Kenilworth Avenue. This is primarily due to the location of depots in the vicinity of Parkdale Avenue, Woodward Avenue and Nash Road.

Table 3.3

1972 TRUCK ORIGIN-DESTINATION DISTRIBUTION

From	To 1	2	3	4	5	6	Total
1 - LOWER CITY	6,825	869	1,209	1,029	550	1,013	11,495
2 - HAMILTON MOUNTAIN	806	208	165	49	12	92	1,332
3 - OTHER AREAS IN REGION	1,391	251	26	35	14	36	1,753
4 - TORONTO	1,307	73	11	-	38	180	1,609
5 - NIAGARA	494	42	19	22	-	89	666
6 - OTHER EXTERNAL	1,287	133	30	195	135	49	1,829
TOTAL	12,110	1,576	1,460	1,330	749	1,459	18,684

% Truck Trips Internal to City of Hamilton	-	46.6%
% Truck Trips with Origin or Destination within Lower City of Hamilton	-	89.8%
% Through Truck Trips	-	3.7%

Source: Trucks in the City of Hamilton(18)
City of Hamilton Traffic Department, 1973

The distribution of truck traffic amongst the Escarpment accesses is summarized below:

Access	Estimated Truck 7-Hr Weekday Truck Volume*
Highway 403	1,600
Beckett Drive	60
James Mountain Road	20
Jolley Cut	240
Claremont Access	400
Sherman Cut	100
Kenilworth Access	550
Mount Albion Road	40
Highway 20	850

*Source: 1977 Heavy Vehicle Volume Overlay
City of Hamilton Traffic Department

Mohawk Road and Rymal Road (Highway 53) accommodates most of the east-west heavy truck movements across the Mountain Urban Area. The 7-hour weekday truck volumes average 400 vehicles along Mohawk Road and 450 vehicles along Rymal Road.

Although the magnitude of the volumes represents less than 10 percent of total traffic, heavy truck traffic contributes greatly to the basic traffic annoyance factors of excessive noise, air pollution and vibration. In the specific area of investigation, the available truck routes are fronted by residential development for significant lengths, particularly by the arterial roads leading to the Escarpment accesses.

Continual concern has been expressed by residents of Upper Ottawa Street, Mohawk Road and Centennial Parkway (Highway 20) regarding noise, vibration

and pedestrian safety. Within the past year, two accidents which resulted in three fatalities and extensive property damage have occurred at the base of the Claremont Access involving heavy trucks.

Guidelines(19) for citing truck routes to minimize environmental damage and improve efficiency of goods movements include the following:

- avoid noise-sensitive areas
- take advantage of natural and man-made noise buffers
- avoid routes with steep gradients
- avoid using roads near older or weak structures
- provide a continuous system with easy access to major through routes
- provide easy access to major generators of truck traffic
- avoid routes with high pedestrian or other traffic conflicts and use routes with limited traffic control restrictions

Within the present urban street network, the scope to limit the environmental damage of truck traffic and to provide efficiency of goods movement is clearly lacking. The growth of present heavy industry and the development of industrial parks will serve to increase the magnitude of this deficiency in the road system.

3.4 LOCATION AND MAGNITUDE OF FUTURE TRAVEL DEMAND

3.4.1 Present Trip Characteristics

The current travel characteristics were derived from the 'Travel Characteristics Survey'(20) prepared by the Regional Planning Department, October, 1975. The home or dwelling unit is the primary generator of trips. Approximately, 85 percent of all urban trips are to or from home. The volume and time variation reflect the daily activities or urban residents.

Daily variations in travel are typified by the pronounced peaking in the morning 7:00 a.m. to 9:00 a.m. and afternoon 3:30 p.m. to 6:00 p.m. periods. Approximately 21 percent of all person-trips takes place during the morning and evening peak hours. During these peaks, 85 to 90 percent of the person-trips are accommodated by car, and 10 to 15 percent are by public transit. The share of urban travel demand accommodated by each of the modes is illustrated in Figure 8.

The preceding discussion underlines the following:

- the strong interrelationship between place of residence and the location of employment, shopping and institutional development as determinants of travel demand. During the P.M. peak period, approximately 71 percent of person-trips are "return home" trips;

- the complementary nature of private and public transportation in handling total travel demand and their respective market share; and

- the peaked nature of the travel demand during the day and the logic of assessing the capacity requirements of both roadways and transit facilities on peak period travel demand.

In this investigation, the P.M. peak hour was selected as a basis of analysis of the adequacy of the present system in meeting future demand. The characteristics of the existing travel demand crossing the Escarpment during the P.M. peak hour are summarized and discussed in the remainder of this subsection.

In Figure 9, the magnitude and distribution of the present travel is illustrated. The predominance of the traffic generated by the Central Area and the Bay Front Industrial Area is clearly evident as these two areas comprise 68 percent of the total demand destined to the Mountain area. The generators of the travel demand are further separated by the internal zones and through traffic. The 1971 percentage distribution of the person-trips upbound crossing the Escarpment during the P.M. peak hour is as follows:

1971 PERSON-TRIP DISTRIBUTION
PM PEAK HOUR

Generator	Southbound Person-Trips Crossing Escarpment	% Total Person-Trips
CBD	4,400	30
Central Hamilton	2,200	15
Bay Front	3,300	23
West Hamilton	1,500	10
East Hamilton	1,600	11
Lower Stoney Creek	400	3
Other Internal	400	3
External	600	5
	14,400	100%

Source: Regional Planning Department

3.4.2 Description of Travel Demand Forecasting Procedure

Growth in population and employment will increase the amount of travel within the Region. The planned timing and distribution of residential development and the concentration will dictate, to a large extent, when and where the growth of travel demand will occur. A forecast of the expected future travel desires are needed for informed transportation decision making.

Travel demand forecast models have been used as tools in transportation planning during the past three decades. During this period, the procedures have been refined to improve their performance as valuable tools in the transportation planning process. Further detail regarding the modelling procedure used is provided in Appendix B.

Generally, demand forecast models serve three basic purposes:

i) to improve the understanding of the factors which influence travel demand;

ii) to test various transportation concepts by identifying the relative performance of alternatives and the associated impacts; and

iii) to provide information regarding the magnitude, location and priority for policies, programs and projects.

The transportation planning process is carried out in a continuously changing environment. Social values, priorities and the relationship amongst the associated factors are in a constant state of flux. Changing attitudes towards energy, staggered work hours, and the environment will affect the use of the transportation system and the temporal variation of travel patterns.

The planning environment underlines the need to identify the sensitivity of the travel forecasts with possible changes in factors affecting trip making and to maintain a degree of flexibility in the transportation system to effectively respond to these changes.

Despite a variety of factors influencing travel demand, there remain basic aspects of urban structure which determine the relative effectiveness and efficiency of private and public transportation modes. The national relationships between population, households, automobile ownership and transit ridership since 1951 in Canada are given below:

POPULATION, HOUSEHOLDS, AUTOMOBILES AND
URBAN TRANSIT USE TRENDS IN CANADA
1951 - 1975

Year	Population	Households	Auto Ownership	Transit Useage (Billions)
1951	14,000,000	3,400,000	2,100,000	1.40
1961	18,200,000	4,600,000	4,300,000	0.94
1971	21,600,000	6,000,000	7,000,000	0.97
1975	22,800,000	6,800,000	8,900,000	1.16

Source: The Future of the Automobile in Canada
Transport Canada, April 1979

The implications of the above are important. Firstly, they show that household growth has become the leading indicator in urban development. The relationship between household and auto ownership growth rates is strong. Travel forecasts based on population growth will become increasingly misleading. Household growth should be substituted for population in any projection of travel demand. Consistent with this, the forecast of future travel demand in Hamilton-Wentworth takes into account household formation and structure characteristics.

Secondly, as more than 50 percent of the housing stock and urban fabric in Canada have been built since 1951, (see ref. 13 pp 4) major changes in urban form and housing density are limited to at least the end of the century. This is particularly relevent to Hamilton-Wentworth, as the planned development is projected to continue past trends in residential development with the reinforcement and expansion of the existing and approved employment and activity centres.

Given the foregoing, the process of determining the future road deficiencies involved a three-step process:

- projecting the growth in travel demand in terms of total person-trips across the Escarpment;
- selecting an appropriate share of the total travel demand to be accommodated by public transit; and
- comparing the capability of the present roadway system to provide for the residual auto travel demand.

3.4.3 Forecast of Person-Trips

As established in the preceding discussion, growth in urban travel demand is closely related to the increase in the number of households. The growth in the person-trips crossing the Escarpment during the P.M. peak hour in the peak direction, between Highway 403 and Highway 20, is compared below with the increase in dwelling units.

Year	No. of Households Mountain Urban Area	Vehicle Person Trips	Person Trip Rate Per Household
1971	34,400	14,400	0.42
1976	38,600	16,100	0.42
1980	42,500	19,400	0.45
2001	66,500	32,200	0.48
Designated Development Capability	84,300	38,700	0.46

Source: Regional Planning Department

The above tabulation underlines the strong correlation between the number of dwelling units south of the Escarpment and the person-trips crossing the Escarpment. Further, the projected trip rate is consistent with the current trip making rate.

3.4.4 Role of Public Transit

No single vehicle is ideal for urban transportation. Urban travel demand must be accommodated efficiently by the combined use of public transit and private auto. Public transit is not efficient or effective in providing the convenience of the automobile for travel from virtually any origin or any destination within the urban area. However, public transit can be effective and attractive in providing transportation into major centres of activity and employment along well defined radial corridors. Virtually all urban transit systems are radial systems focused on the core area. This is a result of a self reinforcing interaction between transit demand and its supply characteristics.

At present, approximately 11.0 percent of the daily person-trips within the urbanized area are accommodated by public transit. This is consistent with experience in other communities of similar size. For the Mountain Urban Area, approximately 12.5 percent of the daily person-trips are provided for by public transit. The average daily weekday transit ridership associated with the Mountain Urban Area totals 35,000 daily trips. The general distribution is as follows:

Origin of Trips	% Daily Transit Trips
Hamilton C.B.D.	39%
Central Hamilton	17.5%
East Hamilton and Stoney Creek	11%
West Hamilton	11%
Bay Front	3%
Local Trips on Mountain	18.5%
	100.0%

Source: Hamilton Transit Study - Phase II:
Table 6; June 1973

The estimated annual transit trips per capita for the Mountain Growth Area is approximately 90 annual transit trips per capita. The total HSR system is compared with ridership rates in other communities below:

Municipality	Service Area Population	1980 Annual Transit Trips per Capita
Calgary	591,700	93
Edmonton	521,200	134
London	266,000	70
Mississauga	305,300	39
Ottawa	493,000	160
Winnipeg	564,500	105
Hamilton	376,100	76

Source: Canadian Urban Transit Association "Operating Statistics of Member Systems (1980-81)", October 1982

While the ridership compares favourably with the average of the above communities, the important observation is the wide fluctuation amongst communities despite the similarities in population. It underlines the need to assess the scope for major increases in transit useage based on a review of the characteristics of the specific community.

The modal split to transit based on available information from the Mountain Urban Area to other areas of the City is compared below with the assumptions incorporated into the travel demand forecasts.

	PM PEAK HOUR % MODAL SPLIT TO TRANSIT		
Area	Current	2001	Designated Development Capability
CBD	21%	28%	39%
Central	15%	19%	17%
East Hamilton	11%	11%	16%
West Hamilton	16%	15%	18%
Bay Front	6%	15%	17%
Lower Stoney Creek	3%	6%	14%
Suburban	2%	11%	13%
Average Modal Split to Transit	13.4%	16.8%	24.0%

Source: Regional Planning Department

As outlined earlier, the forecast development will be an extension of present trends without a marked change in the urban form within the Region. The transit system will continue to be based on a surface bus system within the planning period to 2001. Possible improvements in transit services to the Mountain Urban Area include expanded service as growth occurs, express

operations, and transit priority measures. Provision of transit priority measures appears limited as the introduction of these will have an impact on the total roadway capacity.

The response of the public to higher automobile operating costs, both in terms of fuel or parking charges, manifests itself either in the increased use of public transit or higher vehicle occupancy. In terms of public transit useage, the significant increase in fuel costs has not had a major influence on transit ridership. The average transit trips per capita have relatively remained stable during the past 10 years on the HSR system.

Year	Population (Mountain Urban Area)	Transit Trips (p.h.p.d.)	Transit Trip Rate (000 Population)	% Increase
1971	117,000	1,900	16.2	-
1976	124,500	2,100	16.9	4%
1980	129,300	2,600	20.1	19% relative to 1976
2001	177,000	5,400	30.5	52% relative to 1980
Designated Development Capability	216,700	9,300	42.9	113.4% relative to 1980

The forecast role for transit in the future was chosen given the present performance and the degree to which the planned development and the effects of increasing auto operating costs would enhance the performance of public transit. Given the public transit system to 2001 will consist of a surface bus system focused on the CBD, the major increases in the rate of transit use have been assumed for travel into the core area. With 39 percent of present transit trips destined to the Mountain originating in the CBD, increased transit use assumptions have greatest impact on this segment of travel. Major

improvements in transit service in terms of reduced travel time, and the effects of parking charges cannot be reasonably assumed for the other generators of trips destined to the Mountain.

Based on the foregoing, an overall forecasted increase in the rate of transit use per capita of 50 percent by 2001 for residents in the Mountain Growth Area appears reasonable. For the Designated Development Capability, an assumption of a 100 percent increase in the rate of transit use is optimistic. Aggressive policies related to higher levels of transit service, higher parking rates, and restricted parking availability will be required to achieve this objective.

3.4.5 Growth of Auto and Truck Traffic

The past and projected growth in vehicular traffic crossing the Escarpment between Highway 403 and Highway 20 is summarized in Table 3.4. The forecasts separated by individual screenline are highlighted in Table 3.5.

Table 3.4

SUMMARY OF ESCARPMENT TRAVEL DEMAND
PAST, CURRENT AND PROJECTED VOLUMES
P.M. PEAK HOUR, PEAK DIRECTION

Year	Population Mountain Growth Area (Regional Population)	Households: Mountain Growth Area	Person Trips	Transit Person Trips (%)	Vehicle Person Trips	Vehicle Volume Per Hour
1971	117,000 (391,800)	34,400	14,500	1,900 (13.1%)	12,600	9,600
1976	124,500 (409,800)	38,600	16,100	2,100 (13.0%)	14,000	10,800
1980	129,300 (410,500)	42,500	19,400	2,600 (13.4%)	16,800	12,800
2001	177,000 (445,000)	66,500	32,200	5,400 (16.8%)	26,800	19,400
Designated Development Capability	216,700 (550,000)	84,300	38,700	9,300 (24.0%)	29,740	21,300

Table 3.5

SUMMARY OF TRAVEL DEMAND FORECAST

P.M. PEAK HOUR, PEAK DIRECTION

Screenline	1981	2001	Designated Development Capability
WEST SCREENLINE			
Person Trips	2,400	7,700	9,200
Transit Passengers	150	500	600
Vehicle Volume	1,800	5,200	6,200
CENTRAL SCREENLINE			
Person Trips	14,400	18,800	22,800
Transit Passengers	2,400	4,600	8,200
Vehicle Volume	9,050	10,300	10,800
EAST SCREENLINE			
Person Trips	2,600	5,700	6,700
Transit Passenger	150	300	500
Vehicle Volume	1,850	3,900	4,500
TOTAL ESCARPMENT			
Person Trips	19,400	32,200	38,700
Transit Passengers	2,600	5,400	9,300
Vehicle Volume	12,700	19,400	21,300

3.4.6 Sensitivity Analysis of Travel Demand Forecasts

Estimates of future travel demand levels tend to reflect present attitudes, behavioural patterns and socio-economic conditions. The sensitivity of travel estimates to possible changes in travel peaks, vehicle size and useage were examined in Hamilton as part of the analysis of travel demands. The assessment of the potential effects of the following factors was included:

- increased road congestion and parking supply;
- modified work week providing a reduction in the number of days worked in each week;
- staggering of the hours of work to reduce peak period demands;
- shifting of non-work travel to off-peak periods;
- changes in car ownership characteristics;
- increases in car occupancy rates; and
- smaller vehicles.

Increased Road Congestion and Parking Supply

In the short term, permitting road congestion to increase can mean a spreading of the peak period, a reduction in the discretionary "non-work" trip rates and particularly, a shift to public transit. In the longer term, the presence of significant road congestion can materially retard development, i.e., development will locate in areas of less congestion.

The significant increase assumed as the rate of public transit usage reflects the possible implications of increased road congestion. Significant expansion of the road system focused on the core area has not been considered consistent with Regional policy to promote greater transit ridership in these corridors.

Modified Work Week

In its basic form, the modified work week involves a reduction in the number of days worked with an offsetting increase in the daily work hours. From a transportation point of view, the impact of 25 percent of the employment being placed on a 4-day, 10 hour/day work week would result in a 5 percent reduction in peak hour traffic.(21) However, some potential transportation disadvantages which could offset the effects of the shorter work week include:

- an increase in recreation, shopping and other types of travel;
- the peaks in mid-week would not likely be reduced due to a desire to group non-work days; and
- transit useage may also decrease in direct proportion to the decrease in commuting trips

Staggered Work Hours

Spreading the travel peak through staggered work hours includes such formats as internal staggering within an organization or external staggering involving a number of firms.

The major industries characterized by Stelco, Dofasco, International Harvester and Westinghouse presently provide extensive work staggering through the 3-shift program. Little potential to increase work staggering exists in the industrial sector. Therefore, the impacts of work staggering are more pertinent to core area employment.

Based on the assumption of a work staggering spread of two hours, the reduction in auto travel is not expected to be larger than 5 percent. A three-hour staggering period, which would be difficult to achieve could, result in a 5 to 10 percent reduction in auto travel during the P.M. peak period.

Shifting of Non-Work Traffic

The peak hour demand in most cities is comprised of about 75 percent work trips and 25 percent non-work trips. These non-work trips include business, social and shopping trips. If it is assumed 25 percent of the non-work traffic could be diverted through parking pricing policies, for example, the result would be a 5 to 6 percent reduction in peak hour traffic demands.

Car Ownership

The rate of car ownership is a basic determinant in the amount of automobile travel. Since 1950, the car owning households increased nationally from 42 percent to 79 percent in 1979*. Many factors influence car ownership rates, including population characteristics, income levels, and life styles.

The population and employment forecasts imply a continuation of current trends of higher labour participation rates. The work-trip rates per person in the peak hour have been assumed to increase at the same rate. Given this trend, auto ownership is expected to remain at or above present levels.

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*The Future of the Autombile in Canada; Transport Canada, 1979

Reduction of Work Trips

The non-transport alternatives including telecommunications and computerization, have potential for reducing work trips. However, it is doubtful if the employer would regard a home or remote work centre as an efficient work environment. It seems unlikely that more than 1 percent* of the work force could substitute telecommunications for existing travel patterns by the end of the century.

Unless severe oil shortages and relatively high fuel prices occur, the recent improvements in fuel efficiency in automobiles is expected to keep pace with the increases in operating costs. The proporation of disposable income related to owning and operating an automobile will remain relatively stable.

Vehicle Occupancy

The average vehicle occupancy rate during the P.M. peak hour crossing the Escarpment is approximately 1.33 persons per vehicle.(22) Assuming 25 percent of the home-based work trips are candidates for increased occupancy, and that the occupancy is increased by 50 percent to 2.0 persons per vehicle, the resultant reduction in the P.M. peak road volumes would be 8 percent. The average vehicle occupancy resulting from this assumption would be approximately 1.45 persons per vehicle. The travel demand forecasts have assumed an vehicle occupancy of 1.38 persons per vehicle.

*The Future of the Automobile in Canada
Transport Canada, 1979

Car Size

The trend towards a smaller automobile is sometimes suggested as a possible strategy for increasing the capacity of the road system. Reduction in vehicle length may have some effect on storage lengths for intersection turning bays, but it is not expected to have any significant effect on the capacity of the roadway because of the stop - start operation so prevalent in urban areas.

Summary of Sensitivity Analysis

It is recognized that estimated benefits accrueing from individual strategies cannot be summed directly. In some cases, the impact of one option is offset by the introduction of other strategies. For example, implementing staggered work hours and modified work week tend to mitigate against achieving higher vehicle occupancies and to some degree against higher transit ridership.

Given these non-structural options were independent, the maximum expected reduction in vehicle volumes would be as follows:

Non-structural Option	Potential % reduction in travel demand
• road congestion (accounted for in forecast through transit ridership estimates)	-
• modified work week	5%
• staggered work hours	5%
• shifting of non-work traffic	6%
• car ownership	-
• reduction of work trips	1%
• car occupancy	5%
• car size	-
Total Theoretical Potential	22%

However, considering interdependence of some of the above and the portion of the travel demand on which they would impact, i.e., no impact on truck volumes or through traffic volumes, the combined influence of the non-structural options could result in a reduction in the vehicle forecasts ranging between 8 and 12 percent. Conversely, if the projected rate of transit demand is not achieved, the vehicle forecasts could be 7 to 11 percent greater depending on the vehicle occupancy rate. The vehicle forecasts used in the analysis represent an average of the two conditions.

The non-structural options reviewed have potential to reduce peak period auto travel. This potential has been considered in the vehicle forecasts used in this investigation. The influence of these factors requires an extended period of time to realize their potential. The significant increase in transit useage beyond 2001 is, in fact, a proxy for the possible influence of these factors. The forecasts of travel demand provide a sound indication of the magnitude of the vehicle volumes resulting from the planned growth at future points in time. They include assumptions of higher transit useage, particularly in those corridors approaching the central area. The forecasts are considered consistent with transportation policies which include the limiting of parking availability and higher parking rates. The relationship between the 2001 vehicle demand and transit demand for each screenline is illustrated in Figure 10.

3.5 ESTIMATE OF FUTURE ROAD DEFICIENCIES

The projection of 2001 traffic volumes indicate significant capacity deficiencies will occur along the Escarpment screenline. The results are summarized in the following table:

	Present Practical Capacity	2001 Traffic	Peak Direction Capacity Deficiency
West Screenline			
• Wilson St.	4,200	5,200	1,000 vph
• Highway 403			
Central Screenline	9,700	10,300	600 vph
• Beckett Dr.			
• Jolley Cut			
• James Mountain Rd.			
• Claremont Access			
• Sherman Cut			
• Kenilworth Access			
East Screenline	2,500	3,900	1,400 vph
• Highway 20			
• Mt. Albion Rd.			
Total Escarpment	16,400	19,400	3,000 vph

The projected 2001 capacity deficiency represents an equivalent deficiency of 4 arterial lanes in the peak direction crossing the Escarpment. The projected vehicle volumes crossing each screenline exceed the capacity of the individual screenline.

Achievement of greater transit useage is critical. If current transit rates of use continue, the total deficiency could reach an equivalent of six arterial lanes. Despite a much greater rate of useage, the traffic forecasts for the Designated Development Capability indicate the deficiency of up to four arterial lanes will prevail. The relationship between the vehicle demand forecasts and the capacity of the present road system is illustrated in Figure 11.

Importantly, as indicated in Figure 10, less than 10% of the total traffic is generated by traffic passing through the area. The roadway deficiency is being created by the locally generated traffic.

4. DESCRIPTION OF EXISTING ENVIRONMENT

The Enviromental Assessment Act requires a description of the environment that will or may be affected directly or indirectly by the proposed undertaking or its alternatives. The environment is defined in very broad terms. It includes not only the natural environment of air, land, water, plants, and animals, but also the man-made environment of social, economic, and cultural activities that influence humans.

In collecting data regarding the existing environment, the Region was guided by the following investigative approach:

i) the inventory of the various components of environment will vary in detail depending on the stage in the decision-making process. For example, only very general data is required at the initial screening phase to eliminate certain alternatives from further consideration. However, general data will not be sufficient to make a final selection of a preferred alternative.

ii) the area of investigation is not identical for all elements of the environment. For example, the social effects of the undertaking may be more widespread than the impacts on the natural environment.

The description of the existing environment provided in this section of the submission has been grouped into the following major categories:

- social;
- economic;
- natural; and
- present municipal services.

This information base was used as source material to establish an appropriate geographic area in which to investigate alternatives and to carry out an initial screening of the options. Further, more detailed information was assembled in later stages of evaluation. These further inventories were focused on areas of key significance in the decision making.

4.1 SOCIAL ENVIRONMENT

As illustrated in Figure 3, the Regional Municipality of Hamilton-Wentworth is comprised of six area municipalities of Ancaster, Dundas, Flamborough, Glanbrook, Hamilton, and Stoney Creek. The geographical relationship and the boundaries of each municipality are illustrated in the exhibit.

The present population and employment within each of the area municipalities is summarized below:

PRESENT POPULATION AND EMPLOYMENT

Municipality	Population (1980)	Employment (1971)
Ancaster	14,400	2,000
Dundas	19,500	4,600
Flamborough	24,200	3,400
Glanbrook	9,700	1,500
Hamilton	306,800	135,000
Stoney Creek	35,900	6,800
	410,500	153,300

Source: Regional Planning Department

Most of the Region's existing population is located within a continuous central urban area which consists of the City of Hamilton and parts of the Towns of Dundas and Stoney Creek. The central urban area is flanked by small urban communities in the former villages of Ancaster and Waterdown. The remaining land area in the Region is of a rural character, containing a mixture of hamlets, scattered strip residential developments, and agricultural lands.

The Region, therefore, provides for a variety of living styles including a central compact urban environment, suburban communities, rural hamlets, rural residential development, and farmsteads.

The inventory of the social environment focused on the existing and planned urbanized area within and adjacent to the City of Hamilton. The assessment of future travel demand growth narrowed the area of investigation to the area comprised of the City of Hamilton, the easterly portion of Ancaster, and the westerly portion of Stoney Creek bounded by Fruitland Road.

4.1.1 Existing Land Use

The present land use within the area of investigation is illustrated in Figure 12. The following data has been displayed:

- residential development, including neighbourhood boundaries
- commercial land use
- industrial land use
- rural/agricultural
- institutional, including schools, hospitals, colleges, universities; and
- open space/recreational development

During the past 20 years, residential growth has taken place south of the Escarpment and east of the Red Hill Creek Valley in Hamilton and the Town of Stoney Creek. Since 1965, the population increase within the city of Hamilton has taken place almost entirely in the area south of Mohawk Road in the Mountain Growth Area.

While residential development has occurred south of the Escarpment, employment growth has intensified within the established core area of the City and the Bay Front Industrial Complex. In excess of 55 percent of the total employment in the Region is focused in the following areas:

Employment Area	Employment (1971)
Hamilton Central Business District	30,100
Bay Front Industrial Complex	46,800
McMaster University Area	5,800
Stoney Creek Industrial Park	2,000

The major outlying commercial complexes within the area of investigation are the Greater Hamilton Shopping Centre, Eastgate Shopping Plaza, and the recently opened Limeridge Mall. The major educational and medical institutions are listed below.

- McMaster University and Medical Centre
- Mohawk College
- Chedoke Hospitals
- Hamilton General Hospital
- Henderson Hospital
- St. Joseph's Hospital
- Macassa Lodge Hospital

Agricultural use of the vacant land within the area of investigation is limited because of the urban encroachment. Since City of Hamilton Council adoption of O.P.A. #228 in 1968 and approval by the Minister in 1969, neighbourhood planning has proceeded in the area south of Mohawk Road to Rymal Road (Highway 53).

Very little farming is being conducted on a large scale within the City boundaries. There are some small operations in existence, with the land used for small-scale gardening and commercial production of crops such as corn. The land south of Rymal Road is much more important for agricultural production because it is further removed from designated urbanization. Several large farms are being worked at a commercial scale.

4.1.2 Heritage Resources(23)

Landscape disruptions through development projects such as roadway construction have great potential to destroy heritage and archaeological resources as a consequence of their contextual relationships to the landscape. An overview of the heritage resources was prepared under two sub-headings of archaeology and cultural landscape. Further, detailed investigations were undertaken for the undertaking to provide possible mitigative procedures.

Archaeology

Within the study area, archaeological evidence indicates that old Indian settlements occurred as early as the Laurentian Archaic period (5000 - 3000 B.C.) and during the Middle Woodland period (3000 B.C. - O A.D.). Modern Indian tribes included the Neutrals and Senecas of the Iroquois language group, and later the Mississaugas of the Ojibwa nation.

In 1615, Etienne Brule encountered the Neutral nation, numbering about 35,000 in this area. The Neutral nation occupied the territory until the 1650s. In 1669, when De La Salle visited the area, the Neutrals had been destroyed by the Seneca Iroquois. The Senecas ceded the land, later known as Barton and Saltfleet Township, to Great Britain at the time of the American Revolution in 1776.

In terms of prehistoric archaeological sites within the corridor, no such cultural remains have been cited in available literature. Apparently, this is due to the area under study being heavily disturbed by urbanization and agricultural operations. Very little contextual information remains.

Cultural Landscape

The study area forms a portion of the territory that was purchased from the Mississauga Indians in the late 1700s. This migratory Ojibwa nation inhabited the land ceded by the Senecas to the British. The Five Nations were also resettled in Wentworth County, given land claims by the British for being allies in the War of American Independence.

The Townships in Wentworth County, along with several others in the Niagara region, were surveyed by Augustus Jones, deputy land surveyor, who arrived from the U.S. in 1784 and resided in Stoney Creek.

The Township of Barton was laid out in eight concessions. The dividing roads from Burlington Bay southward were Burlington Street, Barton street, Main Street, Aberdeen Avenue, Concession Street, Fennel Avenue, Mohawk Road, Limeridge Road, and Stone Church Road. These concession roads are 5/8 of a mile apart. The north-south roads were laid out 1/2 mile apart and include Strathearne Avenue, Ottawa Street, Gage Avenue, Sherman Avenue, Wentworth Street, Wellington Street, James Street, Queen Street, Dundurn Street and Paradise Road. This layout provided two 100-acre farms to a block and 21 such farms in each concession.

In 1805, there were only 112 ratepayers in Barton Township, and most of those lived below the Mountain. In 1823, there were three sawmills and one grist mill in the Township. The grist mill was owned by Jacob Rymal, a Mountain resident. These mills were powered by creeks fed by springs. Some of the first settlers lived near Hess Creek, which was once considered as a possible source of water for the City of Hamilton.

It is contended that the first settlement on the Mountain started around the head of the Chedoke Ravine. The first arrivals were established before 1890. By this time, land below the Mountain, where Hamilton is situated, was being taken up rapidly. New arrivals, who sought several hundred acres of free land for farming, were attracted by the unoccupied tracts on the Mountain. Among the newcomers was a group of Pennsylvania Germans.

An early Mountain industry was a lime quarry which was taken from the James Marshall farm. Limeridge Road was so named because the junction of Limeridge Road and the Caledonia Highway was the seat of the industry. Lime from the Barton quarry was used in the City of Hamilton in the building industry. Other quarries were located on the Mountain on top of "Jolly Cut" Road.

Saltfleet Township, which was 28,295 acres in size, was one of seven townships surveyed in 1788 by Augustus Jones. This area was surveyed to accommodate a large number of Loyalist refugees from the United States.

Saltfleet was first settled by Loyalists, some of whom squatted on the lands of their choice prior to the Crown survey. The Township was rapidly occupied, but because most settlers were granted several lots, the first assessment roll of 1816 lists only 102 family households. Most of the lots were 100- and 200-acre parcels.

There were no mills in Barton or Saltfleet Townships during the first years of settlement. A grist mill was established by the Davis family in Mount Albion prior to the War of 1812. Three sawmills and a grist mill were later established in Mount Albion, which is situated on the Mountain four miles southeast of Hamilton in the western portion of Saltfleet Township. In 1880, the community was inhabited by approximately fifty persons of English and Scottish descent. Three hotels, two blacksmith shops, and one general store served the district.

The main thoroughfare through the settlement was aptly named Mud Street. A stone toll road to the City of Hamilton was built in 1880 and a tollgate was built near the Village of Mount Albion. One-half mile west of Mount Albion, the Hamilton and North Western Railroad was built in the 1870s.

One of the most prominent early settlers in Mount Albion was the Davis family, who were Loyalists from South Carolina. This family received 2,300 acres of land from the Crown as payment for their support of the British and losses incurred during the American Revolution.

William Davis started the Albion Mills grist and sawmills. In 1795, a sawmill was erected on the ravine, and shortly after that a grist mill was built. These mills were two of the earliest industries in the district. During the War of 1812, the mills turned out supplies for the British and settler armies. The mill portion of the Davis property was purchased by Elijah Secord in 1814. The mills prospered for over a century until 1907. Today, a large wheel pit is the only remnant of this era.

The Davis family also owned an estate near the Village. The family homestead, Harmony Hall, was built by William Davis circa 1803. This home is believed to be standing at the southwest corner of Mud Street and Mount Albion Road; however, early documentation is unclear as to whether this structure was the home of the Davis family or an inn owned by the family.*

In 1840, on the hill situated south of Albion Falls, there was a 5-storey stone castle built by Mr. William Cook. This home had 14 fireplaces, and was surrounded by 10 acres of parkland. The estate covered 400 acres and was situated at the crossroads of four townships: Salftfleet, Barton, Binbrook, and Glanford. Huge barns were erected for large-scale farming.

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* The Hamilton L.A.C.A.C. believes that this structure is a former inn owned by the Davis family rather than the Davis homestead, Harmony Hall. Based on their research findings, they believe that the home was located north of Mud Street, at the brow of the Mountain.

The site of Cook's castle had previously been occupied by a large barracks building for British soldiers that was built in 1817. No remnants of either building remain today. In the 1870s, Mr. Cook died; fire destroyed the barns; the estate was lost to the family; and the castle was torn down. Today, all that remains are two small lakes and the land is owned by the Hamilton Region Conservation Authority.

A mile down the Valley, north of Mount Albion, was the Vine Vale farm, where hops were produced on a large scale. Part of this farm is now occupied by the Glendale Golf Course.

Both Barton and Saltfleet Townships have been altered from their original states by encroachment of suburban development. The early pattern of farm lots have been subdivided into small lots for homes built generally in the 1940s to 1960s era.

One significant historical structure, an old limekiln on the east side of Upper James Street below Limeridge Road, remains in this area. An old Victorian farmhouse on the west side of Garth Street was identified as a vestige of the rural landscape. Another structure, an early 1900s Georgian-style house, located on Mohawk Road, west of Upper Horning Road, was also identified as an attractive older farmhouse. The latter two buildings are not considered to be significant from either an architectural or a historical perspective.

Two historically significant structures have been identified in Albion Mills at the junction of Mud Street and Mount Albion Road. One building, 197 Mud Street, is an old limestone structure which was formerly a blacksmith shop. Another structure, 158 Mud Street, was either the former home of the Davis family, Harmony Hall, or an inn owned by this family. This wood-frame structure is very old, having been built in the early 1800s, and is in a state of ill-repair.

4.1.3 Recreation and Open Space Development

In establishing a route for a new transportation facility within an already developed urban area, the tendency is to follow the path of least resistance. Thus, it is often the case that greenbelts and open space areas are considered as potential locations for roadways.

The inventory phase included a review of the existing and designated open space facilities in order to establish use, municipal policy, and guidelines regarding replacement standards should an open space area be incorporated into a roadway alternative.

City policy as reflected in(24) the adopted City of Hamilton Official Plan (not approved by Minister) designated an open space system throughout the City. Definitions were established for the role of the open space and park area standards based on population. These standards are given below:

Use	Acreage per 1,000 Population
Neighbourhood	2.5
Community	1.0
District	1.5
City-Wide	5.0
Regional	10.0
	20.0

Within the area of investigation, the Red Hill Creek Valley and its upper reaches surrounding the Escarpment represent the significant open space feature. East - west across the Mountain area, designated open space development consists of neighbourhood and community parks adjacent to and within the existing or proposed residential development.

The Red Hill Creek Valley open space area consists of four distinctive areas as follows:

- the flat area above the Escarpment consists of relatively low topographic relief with a meandering water course and scattered blocks of trees separated by field grass communities. Most of the property is under ownership of the Hamilton Region Conservation Authority. A portion of the area north of Stone Church Road around Albion Falls has been developed for day use activities.

- the Escarpment face and gorge of the Red Hill Creek consists of steep slopes and heavily wooded areas. Scenic views and fast-running water are notable features.

- the broad area of outwash materials north of the Escarpment contains a varied topography, a defined creek valley, and extensive intermixed plant communities. This area contains the King's Forest Park and Golf Course located to the west of Mount Albion Road. At its widest point, the Valley extends 5,000 feet.

- north of Greenhill Avenue, the Valley becomes much narrower and is confined by Valley walls and adjacent urban land uses. The Valley bottom is of poorer soil drainage, and the vegetation communities indicate a high degree of disturbance. The average width of the Valley through this area varies between 700 feet and 1,000 feet.

Within the Valley, the present land use consists of mostly vacant land, with the exception of a few areas including:

King's Forest Golf Course	180 acres
Active sports fields	76 acres
	256 acres

The remaining 440 acres of the Red Hill Creek Valley are undeveloped except for the occasional footpath and dirt bike tracks. The active sports areas include baseball diamonds, tennis courts, soccer and football fields. The

remainder of the Valley, with the exception of the King's Forest Golf Course, is not maintained. In some areas, particularly the upper gorge, a pleasant environment is being adversely affected by indiscriminate use.

The park and open space land distribution, together with the adjacent development, are illustrated in Figure 13.

4.1.4 Visual Resources

Scenic resources are those elements of the natural environment, including views, striking topography, and vegetation, which are considered aesthetic or provide a visual amenity. Assessment of existing scenic resources was based on the "Landscape Evaluation Study - Niagara Escarpment Planning Area" (Niagara Escarpment Commission, April 1976).

Within the area of investigation, the landscape is categorized under the urban visual unit designation. The areas of "attractive" scenic resources are closely associated with the Niagara Escarpment and the Red Hill Creek Valley open space area. As a result, areas of concern in terms of visual resources tend to coincide with designated environmentally sensitive and open space resources areas.

4.1.5 Air Quality

During the past decade, control strategies with an emphasis on industrial sources have achieved a substantial reduction in suspended particulate matter concentrations. According to Ministry of Environment measures, the total suspended particulate (TSP) for Hamilton, as measured at seven sites, averaged 131 g/m^3 in 1970. This average was reduced to 74 g/m^3 by 1977, reflecting a remarkable air quality improvement. At the same time, point source particulate emissions were reduced from 63.0 to 22.5 million lbs./year.

Further significant improvement in urban air quality cannot be achieved solely through control of industrial sources alone. The re-suspension of deposited particles makes a substantial contribution to urban TSP levels. An extensive study(25) was carried out in Hamilton to determine the relative importance of the various source categories contributing to TSP.

The results of the analysis are summarized below, in the downtown area of Hamilton:

Source	Percent Contribution
Area (fugitive dust sources)	19
Point (major point source emissions)	6
Traffic-related (road dust and vehicle emissions)	40
Background (long-range transport component and unidentified sources)	35

The largest contributor to TSP levels are traffic-related. The average contribution was 40 percent, of which road dust accounted for 30 percent and vehicular exhaust 10 percent.

4.1.6 Major Development Proposals

The recent and proposed development within the area of investigation has proceeded based on past commitments to the construction of a major roadway facility. These projects are outlined in the following paragraphs.

a) In Hamilton, a major east - west roadway facility was incorporated as a principal feature of the road pattern and the neighbourhood structure in the Mountain Growth Area. The O.P.A. #228 also affirmed the proposed industrial park in the east Mountain area, a regional shopping centre, and the downgrading of Limeridge Road from a major arterial.

As a result, a right-of-way 60 m in width was designated immediately south of Limeridge Road. Portions of Limeridge Road have been re-aligned and incorporated into the local street sytem.

Of the 18 neighbourhoods abutting the designated right-of-way, 16 have approved neighbourhood plans. Lands under subdivision abut the right-of-way in 11 neighbourhoods. Specific development standards adopted in October 1973 to mitigate visual and noise disruption for properties immediately adjacent to the right-of-way have been imposed in many cases.

The expansion of municipal services and utilities across the right-of-way have been positioned to avoid disruption during construction. The planned major commercial development located adjacent to the right-of-way at Upper Wentworth Street was opened in 1981.

b) In Stoney Creek, the Saltfleet Community Development was premised on the construction of a major north - south freeway access along its western boundary. The present population of the community is approximately 5,800 residents, with a planned development population of 30,000. Regional Council has restricted development of this area to 12,000 residents until such time as improved access is provided.

c) In Ancaster, the Ontario Municipal Board approved the development of approximately 2,000 acres bounded by Highway 53, Highway 403, and the western boundary of the City of Hamilton. The potential residential population of this development is 25,800 residents. The proposal indicates major expansion of the abutting road system to accommodate the residential, commercial, and industrial uses.

The Town's Official Plan includes a major industrial park of 700 acres and a business/commercial centre of 56 acres in the area of the junction of Highways 2, 53, and 403.

4.2 ECONOMIC ENVIRONMENT

4.2.1 Description of Local Economy

The focus of the local economy is the steel industry. The Region is the largest steel producing centre in Canada. With a large protected harbour on Lake Ontario and the St. Lawrence Seaway, Hamilton Harbour is a growing lake and ocean port.

Heavy industry supports the majority of the local population directly or indirectly. A large number of allied industries have developed with the steel industry. These industries include manufacturing of electrical equipment, appliances, chemicals, agricultural equipment, heavy machinery, and textiles.

Hamilton-Wentworth is a regional centre providing a broad range of services to an economic area which extends beyond its boundaries. A number of major educational, medical, and government facilities are located in the Region.

Redevelopment in the central area of Hamilton is vigorous as evidenced by the recently completed Trade and Convention Centre complex. Construction of a major office/commercial tower is underway, and plans are being finalized for a new hotel and a new arena.

The Region possesses significant strengths including skilled labour, infrastructure, and location. The planned growth and development is realistic. Recent growth within the Region has slowed due in part to the economic conditions nationally, and in part to the Region's lack of success in attracting new industrial/commercial development. There has been a shortage of serviced industrial lands and a large portion of the available industrial lands has lacked good access and exposure.

4.2.2 Municipal Tax Structure

Transportation improvements may cause gains or losses in property tax revenues by consuming land suitable for development or by affecting property values adjacent to the facility. To provide an initial appreciation of the relationship of roadway-related expenditures to total expenditures, the following tabulation was prepared.

1981 MUNICIPAL EXPENDITURES
CONSTRUCTION AND MAINTENANCE

	Net Roadway Expenditures	Percent Total Expenditure
Ancaster	$ 370,071	28.12%
Hamilton	14,564,210	26.82%
Stoney Creek	2,439,312	12.94%
Region	9,297,068	14.61%

Source: Regional Engineering Department

4.3 NATURAL ENVIRONMENT

The inventory of the natural environment consisted of reviewing and interpreting existing data sources. Information on soil characteristics, topography, geomorphology, groundwater, vegetation, terrestrial and avian wildlife, and aquatic biology were collected and examined. These aspects were consolidated under the headings of hazard lands, groundwater, geological features, vegetation, terrestrial and avian wildlife and aquatic biology. These parameters of concern are discussed in Section 4.3.1. The discussion of physical parameters emphasizes methodology and concerns; the discussion of biological parameters describes regional perspective and concerns.

In Section 4.3.2, descriptions are presented integrating parameters of concern with geographic areas of concern. In Figure 14, the areas of physical and biological concern are mapped. These "environmental constraint areas" were

defined and delineated through use of existing published reports and maps from several sources and through personal communication with various agencies and knowledgeable persons.

The intended purpose of describing environmental concerns and constraint areas is to provide an informative input into the decision-making processes of selecting roadway expansion alternatives. These areas do not all present equivalent constraints to road alteration or construction. The predicted negative impacts may range from severe and irreversible to moderate with a possibility of successful mitigating measures; thus a careful and detailed interpretation of the various factors presented is essential.

Figure 14 demonstrates the environmental problems of expanding roadway facilities in the study area. Virtually any route will cross areas of constraint. In selecting alternatives, the severity of effects, the cost of mitigatory measures, and the possibility of failure in attempts to mitigate effects are the factors which were weighed early in the study.

4.3.1 Parameters of Concern

Hazard Lands

All of the areas delineated by the Ministry of Natural Resources and the Niagara Escarpment Commission as "hazard lands" are included in the following two constraint categories.

Floodplains:

The Hamilton Region Conservation Authority has undertaken floodline mapping of Red Hill, Tiffany, Ancaster, and Stoney Creeks. The Authority's simplified version of the floodline mapping was used. Additional valley bottoms along minor tributaries were added to this mapping.

Alternatives involving road construction should, whenever possible, seek to avoid floodplain areas. Likewise, to minimize potential impacts on the aquatic systems, especially from sediment loads, the routing of alternatives should attempt to minimize the number of stream crossings.

Erosion/Sedimentation:

The soil survey mapping by the Ontario Department of Agriculture indentifies the surficial soil types in the study area. By applying erodibility factors ("K" values from the Universal Soil Loss Equation) to each soil type and correlating these with slope mapping from 1:25,000 topographical sheets, critical areas of erosion hazard were identified. Areas with slope gradients exceeding 15 percent were delineated. All of these have high erosion potential. Highly erodible soils with slopes of 6 to 15 percent were also identified and mapped.

Within the above-noted areas, the risk is high of significant amounts of erosion and sediment deposition occurring, despite any precautionary measures which may be applied. In other areas, the soil erodibility may be just as great but, because of lower slope gradients, the risk of large quantities of soil loss is lower.

In the study area, the highest erosion hazards occur as follows:

a) at the west end of the Escarpment in the highly dissected, steeply sloping, silty soil landscape

b) along the steep valley and upland slopes of the Red Hill Creek Valley

c) along the extremely steep face of the Escarpment

Other, smaller erosion-prone areas occur across the study area, most in close association with stream valleys. Because of this relationship, the potential for sediment loadings of watercourses, Lake Ontario, and Lake Ontario bays is high.

Groundwater

Over 400 well records from the Ontario Ministry of the Environment were compiled for investigation of the groundwater flow regime in the study area. In each case, the static water level was listed. From these listings, contours were plotted, each representative of the elevation of the existing water table. Only the shallowest water-bearing formations and their associated water levels were considered relevant to road construction.

Generally, groundwater flow in the overburden is restricted. The predominance of glaciolacustrine silt and clay and till deposits effectively impedes flow, as is evident from the numerous surface water courses. Much of the groundwaer flowing through the overburden is discharged locally to surface water courses.

The bedrock, composed of Lockport and Amabel dolomite, transmits larger quantities of groundwater than does the overburden water-bearing formations. This groundwater in the bedrock is a cumulation of the regional system. Much of the groundwater transmitted via the bedrock is discharged as seepage along the face of the Niagara Escarment, where Silurian dolomite comes in contact with the older Ordovican Queenston shale. Because of the massive nature of shale, much of the groundwater is diverted to surface water courses that flow to Lake Ontario.

Infiltration Zones:

Correlation of groundwater mapping with soil, bedrock, and surficial geology data assisted in the delineation of zones exhibiting significant infiltration capacities. The concern is only with the potential threat to local domestic groundwater supplies and base flow for streams caused by addition of an unnatural impervious surface. It is assumed that a multi-lane highway will have little effect on regional base flow.

There are two significant locations to consider: first, the groundwater peak at Garners Corners likely exhibits high infiltration rates. Permeable sandy loams and surficial gravels and sands suggest that percolating precipitation recharges the local overburden water-bearing formation.

The second zone of high infiltration is the Lockport and Amabel dolomite bedrock, positioned immediately above the Escarpment face. Fractured dolomite and limestone exposures readily receive infiltrating precipitation.

Varying degrees of infiltration also occur in the overburden below the Escarpment where sequences of beach sand deposited by the ancient Lake Iroquois were deposited. Zones of highest infiltration occur where permeable soils overlay pervious surficial materials.

Shallow Water-Bearing Zone Distribution:

Well logs containing a surficial granular layer were outlined when the granular material was interpreted to be less than 50 feet below the surface. At these locations, deep road cuts could potentially intersect the water-bearing formation causing adverse alterations to the local groundwater flow regime. The objective, therefore, is to avoid damming groundwater flow or raising the water table through compaction and backfilling.

It is assumed that there is hydrogeologic connectivity where wells fulfulling the proposed criteria are clustered. This occurs at three locations within the study area, namely:

- Below the Escarpment in the vicinity of Red Hill Creek and Stoney Creek.
- Immediately above the Escarpment south of Ancaster Heights
- In the vicinity of Garners Corners and trending into the City limits

High Water Tables:

High water tables are considered a hindrance to road construction because of the formation of uncertain drainage patterns. Zones of high water tables were plotted throughout the study area. High water tables occur in poorly drained soils, consolidated surficial materials, and over massive bedrock formations.

Significant Geological Features

The Earth Science Candidate Nature Reserves scheme was followed in identifying geological features of local or regional significance (OMNR, 1976, Earth Science Nature Reserve Candidates).

Vegetation

The study area lies entirely within the Carolinian Region in Southern Ontario (as defined by Soper, 1962). This region, although more extensive in the eastern United States, is restricted in Canada to Southwestern Ontario. Many indigenous plant species are characteristic of the Carolinian region, including Black Walnut, Sycamore, Swamp White Oak, Green Violet, Twinleaf, Burning-bush, Sassafras, Pignut Hickory, Tulip-tree, Horse-Balm, Yellow Oak, and others. Several examples of these are found within the study area.

Although sparsely forested, the study area does contain several significant wooded areas, most of which are Escarpment-related or located within the Red Hill Creek Valley. Several of these exhibit characteristics of the original Carolinian vegetation. These wooded areas currently occur in varying states of maturity and disturbance. Some are locally significant farm woodlots which once supplied lumber and fuel to area farmers and which now provide food and shelter for many species of wildlife and also provide visual relief to the landscape. These woodlots have microclimatic influences which tend to moderate extremes of weather patterns. Many of the larger wooded areas are regionally significant. Most have been identified as Environmentally Sensitive

Areas in the Regional Municipality of Hamilton-Wentworth(26) for several reasons and these are presented in Section 4.3.2.

Several rare and phytogeographically interesting plant species occur in the study area. Many species which are restricted to the Carolinian Region, and thus reach the extreme limits of their natural range in Canada, are included here. Several species are listed by Angus and White (1977) in "The Rare Vascular Plants of Ontario". These are described in Section 4.3.2 dealing with environmental constraint areas. In addition, planted orchards and vineyards are present in sufficient quantity in the study area to merit some investigation of their role and value in the ecology of the area.

Terrestrial and Avian Wildlife

The Hamilton-Wentworth Region lies in the transition area of two major life zones, the Carolinian and the Great Lakes - St. Lawrence life zones. This blending of the two zones produces a high diversity of wildlife communities with many species occurring at the extremes of their natural range in Canada.

However, the study area is primarily an urbanizing environment with peripheral rural lands. Many species of wildlife that persist are those commonly found in residential areas. These include robins, house sparrows, starlings, raccoons, squirrels, pigeons, and others.

The more varied communities of wildlife are restricted to farm woodlots, marshes, hedgerows, valleys, and Environmentally Sensitive Areas (Ecologistics, 1976) where natural vegetation persists. The diversity and size of populations are greatly affected by the quality of the environment. For example, the survival of natural vegetation, the air- and water-borne pollutant levels, and the degree of disturbance to wildlife from such urban impacts as traffic and recreational use contribute to the quality of an area's environment.

In addition to quality, size and proximity to other natural areas are important in maintaining diversity. When an "island" of habitat is created - for example,

a woodlot isolated by cultivated fields - the number of wildlife species will decrease over time. A stable number is eventually reached which is less than the initial number of species; how much less is directly related to the size of the island and its proximity to, and connections with, other areas of similar habitat (Diamond, 1975).

In summary, the diversity of wildlife which will persist in a natural area depends on the quality of the area, the size of the area, and the ecological links connecting it to other natural areas. The locations and description of environmental constraint areas for wildlife are presented in Section 4.3.2.

Aquatic Biology

Surface waters in the study area consist of streams, intermittent streams, channelled drainage ditches, and small ponds. Neither major waterways (excluding Lake Ontario) nor significant fisheries resources occur within the area.

The ponds and associated marshes in the lower reaches of streams are physically small but ecologically important as refuges for the wildlife species that inhabit these diminishing wetlands as well as for migrating birds. Few such marshes and ponds occur east of Hamilton Harbour, so those that do remain are of particular significance both as remnant habitats and as staging areas for migrating waterfowl.

The smaller upstream ponds and streams of the study area have supported a number of invertebrates and small fish species (Department of Energy and Resources Mangement, Conservation Authorities Branch, 1968). However, reduced water quality has had a severe impact on the flora and fauna of these surface waters. Urbanization has increased surface flow rates through an overall decrease in soil permeability (rooftops, roadways, storm sewers) which has led to flooding and increased erosion during periods of high flow and to decreased summer flow rates. In summer, portions of some streams dry out completely and upstream ponds show high levels of algal growth and low levels of oxygen.

Rehabilitation is a future possibility which could enhance the recreational as well as ecological value of the Red Hill Creek watershed. At present, the main ecological value of these surface waters is in their role as support to wildlife species which are not fully aquatic but which do require the presence of surface waters.

Many mammals, birds, reptiles, and amphibians visit streams and ponds for drinking and bathing. A number of species which rely on invertebrates for food have an abundant and reliable food source among the invertebrates which are produced from surface waters. In considering the deteriorated quality of the waters in the study area, it is important to recognize that even damaged waters may contribute to the well-being of nearby vegetation and wildlife. Even temporary ponds and ponds in which algal blooms deplete oxygen in late summer provide habitat for many invertebrates and the larvae of frogs and toads. These species in turn provide food for reptiles, birds, and mammals.

In summary, the surface waters of the study area have been altered by urban development, but still contribute to the ecological well-being of the natural areas around them.

4.3.2 Environmental Constraint Areas

The term "environmental constraint areas" has been selected to encompass:

i) those areas of particular sensitivity to impacts of construction on soils, groundwater, and surface waters; and

ii) those areas of provincial, regional or local significance for their geological or topographical formations, their vegetation communities, and their wildlife populations. These include Environmentally Sensitive Areas (Ecologistics, 1976).

The environmental constraint areas that have been defined within the study area are illustrated in Figure 14 and described in the following section of the report.

Areas Sensitive to Construction

(i) Upper Red Hill Creek Vinemount Shale

This exposure of Vinemount shale, Eramosa bedrock formation is described as rare (OMNR, 1977, Industrial Mineral Resources Inventory) and is of at least local, possibly Regional, significance. Its status should be clarified if a construction alternative is chosen near it.

(ii) Orchards and Vineyards

These types of agricultural use represent a particularly heavy long-term investment and are often the most persistent rural remnants in an urbanizing environment. These agricultural uses have been mapped from Canada Land Inventory mapping (n.d.). The impact of a selected route through or adjacent to any of these areas should be considered in terms of economics, viability, and social value of the area.

(iii) Productive Woodlands

Productive woodlands have been identified. These woodlands may be of local importance as remnants of Carolinian vegetation, as refuges for wildlife, and for visual amenity and recreational potential. The status and viability of each should be considered if a route is selected in or near it.

(iv) Non-Productive Woodlands

Non-productive or immature woodlands, indicated by current data, may be of local importance as early successional stages in the normal progression of vegetation to a climax stage. A number of rare or unusual species may be located only in these early successional stages and may be preferred habitat for many species of wildlife. The status and potential of any of these woodlands should be considered if a route is selected in or near it.

Identified Areas of Natural Environment Significance

(i) Stoney Creek Ravine

The area is identified as one of nine principal fish and wildlife habitats in the Halton-Wentworth waterfront area (Acres Consulting Services Limited, 1974). The area is of value only to those fish and wildlife species which are tolerant of high levels of human contact.

(ii) Tiffany Falls

Tiffany Falls is designated a Regionally significant geological feature within the Niagara Escarpment Planning Area (OMNR, 1976, Earth Science Nature Reserve Candidates).

This area provides an important green space link between the Hamilton Mountain Escarpment on the east and the Dundas Valley on the north. The western half of the area contains ravines. The eastern section has soils of the well-drained Ancaster silt loam and Oneida clay loam. The slopes in the area are very steep with ravine slopes ranging from 15 to 30 percent.

The creek and resultant waterfall along with the scenic beauty, geological and ecological conditions add important dimensions to the local area. The area provides important nesting and breeding areas for the Louisiana Waterthrush and the Black-throated Green Warbler. Source: Hamilton-Wentworth Region Environmentally Sensitive Area No. 21.

(iii) Hamilton Mountain Radial Line

This area is designated as Wildlife Sensitive Area #55 in the Niagara Escarpment Planning Area (OMNR, 1977 Wildlife in NEPA). Field studies by Wormington (1976) determined that the bird population density of this area is approximately two times greater than the average of other study areas in Southern Ontario. The presence of territorial male Alder Flycatchers (Empidonax alnorum) and yellow-breasted Chats (Icteria virens) is of Regional significance.

The Hamilton Mountain Radial Line contains a mixture of biological habitats and ecological succession stages that has been of interest to local outdoor enthusiasts. The surficial deposits are thin lacustrine clay and silt over silty clay loam till. The major soil is well-drained Ancaster silt loam developed on silty clay loam till. Small areas of Alberton silt loam occur along the drainage depressions. Slopes above the Escarpment are in the 9 percent to 15 percent range. In the south of the area, they are in the 15 percent to 30 percent range.

The Niagara Escarpment is a geological landform extending over 380 miles through southern Ontario. In the Hamilton area, it is present as a prominent topographic bedrock feature with a vertical drop of over 200 feet. The most common expression of the Escarpment is the mantled scarp, formed as a consequence of differential erosion of resistant caprock and softer underlying rocks (Hewitt, 1971).

The plant communities are diverse in nature and are of high quality in their species composition and abundance. The Sweet Chestnut tree was once common, but was virtually eliminated by a fungus disease near the beginning of this century. One large specimen (15 inches diameter at breast height) of this species can be found at the east side of this area (Gilmore, pers. comm). Sassafras trees are found in the same general area as the Chestnut. This Carolinian species is uncommon in the Region. Native Crab Apple and Black Walnut are also found.

The property has an unusually high diversity of biological communities and the associated plants and animals. Some of the plant communities include: old pasture successional vegetation; cat-tail marsh, alder swamp; abandoned apple orchard; fern (calcareous bog); stream; second growth, upland deciduous forest; recently cultivated fields; Christmas tree plantation; intermittent ponds; field succession on a very dry habitat (old gravel pit) (Pringle, 1971), and the communities found along the lip of the limestone cliffs of the Niagara Escarpment.

The diversity of the communities and their relative quality is indicated by the rare and sensitive creatures that are able to survive there. These creatures include:

- Masked Shrew
- Smoky Shrew
- Timber Rattlesnake
- Short-billed Marsh Wren
- Red-headed Woodpecker
- Golden-winged Warbler
- Blue-winged Warbler
- Mourning Warbler
- Yellow-breasted Chat
- Tawny Crescent Butterfly

Source: Hamilton-Wentworth Region Environmentally Sensitive Areas Study (1976) Area No. 22.

(iv) Ancaster Creek Headwaters

There is a mixture of old fields, early succession stage forest, and mature forest. Nearby urban development and the accessory urban fringe activities such as trail bike riding have possibly damaged the existing natural communities.

The surficial deposits of the area are mainly lacustrine sediments of clay and silt. Recent alluvium deposits occur in the stream bottom. The major soil is the well-drained Brant deposits. To the east of the area occur a greater variety of soils, namely: the imperfectly-drained Beverly silt loam developed from lacustrine deposits; the well-drained Ancaster silt loam developed from silty clay loam till, and a small area of well-drained Grimsby sandly loam developed from water-deposited sands.

The slopes of the area are generally in the 9 percent to 15 percent slope range with greater steepness adjacent to the stream.

This Environmentally Sensitive Area was described by Ecologistics (1976). Field studies by Wormington (1976) documented several new species. These include Round-headed Bush Clover (Lespedeza capitata) and Bitternut Hickory (Carya cordiformis), which are uncommon in the Hamilton-Wentworth Region, and the Red-headed Woodpecker (Melanerpes erythrocephalus), which nests here in one of only seven regional nesting areas. Source: Hamilton-Wentworth Region Environmentally Sensitive Areas Study (1976) Area No. 23.

(v) Hamilton Niagara Escarpment

The Niagara Escarpment in Hamilton is a thin strip of green that passes through the centre of the urban area. In many areas, reservoirs, roads, expressways, and railways have cut through the

greenbelt but, nevertheless, in the local context the view of the Escarpment forest is important.

A natural area surrounded by altered habitat such as that of a residential community resembles an island from the point of view of species restricted to natural habitats.

The number of species that a natural area can hold at equilibrium is a function of its area and its isolation. Larger areas and areas located close to other natural areas can hold more species (Diamond, 1975). Therefore, it is important that strips of natural vegetation are allowed to remain connecting disjunct natural areas. The Hamilton Niagara Escarpment is a greenbelt that interconnects important natural areas on both sides of Hamilton. It connects the Red Hill Creek - King's Forest area in the east to the Hamilton (Radial Line), Tiffany Falls, and Dundas Valley areas in the west. The City of Hamilton has a system of important environmentally sensitive areas that are well connected by green space on Escarpment and river valleys.

The Escarpment, its forests and its dominant presence upon the landscape are well worth protecting. The lip of the Escarpment provides excellent views of the lower part of the City of Hamilton, Hamilton Harbour and Lake Ontario. The City view is particularly interesting at night. From the Lower City, the Escarpment provides a pleasing textured background to a person's observations to the south. Within the urban area, the aesthetic value of the Escarpment is significant. Source: Hamilton-Wentworth Region Environmentally Sensitive Areas Study (1976) Area No. 24.

(vi) Red Hill Creek - King's Forest

Red Hill Creek pours over Albion Falls into a steep-sided river valley. At this point, there is a notch in the Escarpment that was probably carved by a large river, prior to the last glaciation. About one-half of

the area is wooded with a wide variety of trees. Much of this forest is to be found on the Escarpment and valley slopes. The other half is composed of pastures, old fields and orchards that are slowly growing back into forest.

Red Hill Creek has poor water quality (Department of Energy and Resources Management, 1968; Dillon Ltd., 1975), especially in its lower reaches.

Groundwater follows a moderate gradient into the valley from the west and south/southeast. Considerable amounts probably eventually seep from the bedding planes on the Escarpment face and produce springs. Wells on the top of the Escarpment generally produce reasonable supplies of water from dolomite bedrock. Areas of high infiltration probably occur randomly, above the Escarpment, where bedrock lies near the surface and is sufficiently fractured. Hydrogeologic relationships within the valley are significant in that water discharges from the Escarpment feed the small creeks. Infiltration is not important because of the presence of Halton till.

Halton till is the main surficial deposit, along with the alluvium of the creek. Oneida loam has developed on the till. A small area of Binbrook soil has developed from lacustrine deposits over clay till between the two ravines to the east.

The slopes are complex and generally within the 9 percent to 15 percent range. The creek and Escarpment ravines have slopes steeper than 15 percent.

This area contains the unique landforms of the Niagara Escarpment and a large Pleistocene re-entrant. The upper Escarpment is well exposed, showing the Lockport, Clinton and Cataract rock groupings. The lower units are covered by thick deposits of Halton till.

The Red Hill Creek - King's Forest ecological system provides a very important ecological function in that it is a link between various other similar systems. It is one part of the Niagara Escarpment east-west chain of cliff forests. It also links the Escarpment with Hamilton Harbour and the Lake Ontario shore via the Red Hill Creek ravine and its associated woods and fields.

The importance of linking natural biological communities by strips of similar habitats has recently been pointed out by extensive work on the biogeography of islands (Diamond, 1975). It has been shown that islands have a lower number of species than areas of similar size on a continent. Therefore, if a piece of a large forest is surrounded by some hostile environment, such as a city, then the number of species will decline from the original conditions, even if the remaining forest piece is left completely alone by man (Diamond, 1975).

The biological communities are varied and the presence of many unusual creatures that are sensitive to development indicates that areas of high-quality ecosystem exist. Some of these records are old and were field checked to determine if development had altered some important conditions. Some of the species mentioned are Regionally rare.

This Environmentally Sensitive Area was described by Ecologistics (1976). Field studies of the Red Hill Creek Environmentally Sensitive Area (Wormington, 1976) have documented several additional species of signficance including Black Walnut (Juglans nigra), Flowering Dogwood (Cornus florida) both rare in Ontario (Argus and White, 1977); Sycamore (Platanus occidentalis), Native Crab Apple (Pyrus coronaria) both Carolinian species in Ontario (Fox and Soper, 1952, 1953); Green Violet (Hybanthus concolor) and Small-flowered Leafcut (Polymnia canadensis), both rare in Ontario (Argus and White, 1977). Additional species noted as uncommon in the Hamilton-Wentworth Region include: Bladdernut (Staphylea trifolia), Smooth Sumac (Rhus glabia), Foamflower (Tiarella cordifolia), Bonewort (Cryptotaenia canadensis),

Cow-Parsnip (Heracleum maximum), Water-Pennywort (Hydrocotyle americana), and Long-spurred Violet (Viola rostrata). Albion Falls is designated a regionally significant geological feature within the Niagara Escarpment Planning Area (OMNR, 1976, Earth Science Nature Reserve Candidates). Source: Hamilton-Wentworth Region Environmentally Sensitive Areas Study (1976) Area No. 25.

(vii) Felker's Falls and Niagara Escarpment

This section of the Niagara Escarpment extends from Felker's Falls to the road cut for Highway 20. Felker's Falls is the main drainage path over the Escarpment, in this area, for the stream water arising on the slopes of the Niagara Falls moraine. The erosive force of the water has cut a good set of geologic exposures, into the Escarpment rock, at Felker's Falls.

Most of the area is heavily wooded, but land clearing has removed most of the trees on the land above and below the Escarpment face. A deciduous forest occurs on the uplands around Felker's Falls itself. This area serves as part of a thin green ribbon that extends through the center of the Hamilton-Wentworth Region. Rock Chapel, Dundas Valley, and Red Hill Creek Valley are on the ribbon to the north, and to the south the Niagara Escarpment extends further into the Niagara Peninsula. The connection of nature communities, by areas of similar structure, is important (Diamond, 1975).

Many species of creatures are found only in pieces of natural biological community that have escaped destruction by man. Species of snakes found in these areas are all harmless, innocuous and have quite attractive colours and colour patterns. Nevertheless, they are usually removed as a consequence of habitat removal. This section of the landscape is very steep and therefore has escaped some development pressures.

This Environmentally Sensitive Area was described by Ecologistics (1976). Felker's Falls is designated as a regionally significant geological feature within the Niagara Escarpment Planning Area (OMNR, 1976, Earth Science Nature Reserve Candidates) and is indicated as such in Figure 15. Source: Hamilton-Wentworth Region Environmentally Sensitive Areas Study (1976) Area No. 26.

(viii) Niagara Escarpment - Devil's Punch Bowl East

This part of the Niagara Escarpment extends through the Town of Stoney Creek for more than 6 miles. It contains a long, thin ribbon of forest growing on the north-facing slopes of the cliffs. Several roads pass through the area and quarrying has occurred in a few places. The Devil's Punch Bowl contains good geologic exposures and shows a major geologic transition from the Powerglen sandstone and shales to the Cabot Head shale formation.

This Environmentally Sensitive Area was described by Ecologistics (1976). Within this area lies Paleozoic Candidate Nature Reserve #6, within the Niagara Escarpment Planning Area (OMNR, 1976, Earth Science Nature Reserve Candidates) providing a unique opportunity to view an almost complete geological section representing the bedrock geology of the Niagara Peninsula.

Each bedrock formation represents a slightly different change in paleoenvironment; therefore, an excellent geological interpretive program can be built around this geological exposure. It is recommended that the geological exposures within the Devil's Punch Bowl can be incorporated into the Nature Reserve System as a geological reference section for the Silurian stratigraphy of the Niagara Peninsula (OMNR, 1976, Earth Science Nature Reserve Candidates). This report also notes that the "geological exposure at Devil's Punch Bowl is a natural exposure resulting from stream erosion of the Escarpment edge. This feature will continue to exist as long as

the natural processes of stream erosion continue as they have in the past. The rate of erosion from the creek is not known, although it appears to be quite slow due to the relatively small size of the creek. More information concerning the rate of retreat of the falls upstream is essential for long-term planning of the site". Consequently, any route in or near this area must be carefully considered with regard to this specific geological feature, as well as with regard to effects on vegetation and wildlife in the broader ESA #27. Two additional geologically interesting sites of local significance fall within ESA #27; they are Pa86(L) and Pa87(L).

The high aesthetic value of the Niagara Escarpment is well recognized. The Bruce Trail runs along the rim of the cliffs and provides very enjoyable passive reaction that is based upon the user's appreciation of the scenery , countryside and natural communities. Much of the eastern section has an improved road, running along the Escarpment edge, which is part of the Niagara Peninsula Scenic Drive. Source: Hamilton-Wentworth Region Environmentally Sensitive Areas Study (1976) Area No. 27.

(ix) Red Hill Creek Marsh - Van Wagner's Marsh

The mouth of Red Hill Creek has a system of high quality marshes that are representative of a habitat that was once common in the harbour area (McIlwraith, 1976). Urbanization now surrounds the area and has had its effects. Highways 20, QEW, Burlington Street, Woodward Avenue and a CN Railway line now pass through the area and have reduced the size of the marsh accordingly. The dominant vegetation is cat-tail (Typha latifolia). The water quality of the river near the mouth is poor (MOE) because of the presence of pollutants from a variety of upstream sources.

The marsh likely acts as a living filter or buffer for sediments and nutrients coming in from upstream sources. In this way, it helps to improve the water quality (Dorney, 1973).

This cat-tail marsh is a small remnant of a once-common community in the Hamilton Harbour area. Cat-tail marshes develop in sheltered bays and inlets along the Great Lakes shoreline. In this Region, the beach strip sandbar provides protection from the lake waves and allowed marshes to develop around Burlington Bay. With industrialization and urbanization developing behind an excellent harbour, the marshes were filled in and destroyed. Today, the Red Hill Creek and Cootes' Paradise marshes are the only significant ones left.

The marsh has already been heavily affected by upstream pollution, transportation development, and local industrial development. Nevertheless, much remains that is valuable. Careful management would allow the marsh to invade open water areas near the river's mouth, which would give the rare species more habitat to survive in and make their position less precarious.

This Environmentally Sensitive Area was described by Ecologistics (1976). This area is designated as Wildlife Sensitive Area #57 in the Niagara Escarpment Planning Area (OMNR, 1977, Wildlife in NEPA). It is identified as one of nine principal fish and wildlife habitats in the Halton-Wentworth waterfront area and is designated as a Primary Resource Area, "an important waterfowl nesting area which should be protected from human intrusion" (Acres Consulting Services Limited, 1974).

(x) Stoney Creek Ponds

The Stoney Creek Ponds are elongated water bodies in the lower reaches of streams, most of which originate below the Escarpment. They appear to have been formed by the formation of spits, across the

creek mouths, caused by longshore drift. From the configuration of the deposited material in-between the groynes of this part of the coast, the longshore drift that builds the spits appears to be from east to west. Infilling of the lakes, by sediment brought down by the creek, appears to the taking place. Most of the ponds are connected to Lake Ontario by narrow channels cut through the spits.

The ponds and the associated marshes are small, but important, as refuges for the creatures that inhabit these uncommon habitats. Recent development has eliminated some of the marsh habitats in the ponds but some still remain.

The Stoney Creek has poor water quality, with frequent low, dissolved oxygen levels and occasional high summer temperatures. (Hamilton Federation of Environmental Groups, 1972). Many of the source creeks dry up in the summer. Source: Hamilton-Wentworth Region Environmentally Sensitive Areas Study (1976) Area No. 31.

(xi) Saltfleet Woodlot

This large woodlot sits on a flat clay plain. Drainage ditches drain the surface water west to the Stoney Creek and east to the Forty-Mile Creek. The surficial deposits of the area are lacustrine silt and clay over till. Developed of this are poorly drained Lincoln silty clay loam soils.

The woodlot is the largest piece of native forest in the Region, south of the Niagara Escarpment. It now contains a dump, but the detailed effects of this development are unknown. There is little published information available on this large woodlot. It should be field checked by competent resource personnel in order to ascertain its true status. Further data on this area should be considered if a route is selected in or near it. Source: Hamilton-Wentworth Region Environmentally Sensitive Area Study (1976) Area No. 32.

(xii) Hamilton Golf and Country Club

The golf course and woodlots are located in the urban area of Ancaster and are now surrounded by urbanization. The eastern edge of the golf course contains a large, healthy woodlot with many large white pine trees. The area is drained by and occurs in the upper reaches of the Ancaster Creek. Adjacent to the river, the land slopes to over 15 percent, but higher areas are in the 5 percent to 9 percent slope range. The major surficial deposit is lacustrine sand with some clay and silt. A small area of till occurs in the north section and alluvium is found along the creek.

The soil developed on the alluvium is Alberton silt loam, of variable drainage. Adjacent to the creek is a belt of Grimsby sandy loam and Brant silt loam, both of which are well drained and have developed on lacustrine sands and silts. On the higher ground, in the south, occurs well drained Springvale sandy loam developed from lacustrine sands over outwash gravels. At the north end and west of the river occurs the well drained Ancaster silt loam that has developed from a till. A soil complex of Grimsby sandy loam and Ancaster silt loam in the east and north, and the poorly drained Toledo silt loam developed from lacustrine silt and clay.

The depth to bedrock varies considerably with this area of complex surficial deposition. The presence of locally occurring sand and gravels would seem to make infiltration significant, but the water yield is too low to consider the area as an aquifer. Field observations are necessary in this case to assess the importance of the area providing groundwater infiltration.

This area was described by Ecologistics (1976). No more recent information on the area has been found, and its current status should be verified in the field, if a route is selected in or near it. Source: Hamilton-Wentworth Region Environmentally Sensitive Areas Study (1976) Area No. 38.

4.4 DESCRIPTION OF PRESENT INFRASTRUCTURE

This section provides an inventory of the present infrastructure of roads, public transit, major utilities and railroads within the selected area of investigation.

4.4.1 Inventory of Major Road System

In carrying out the inventory of the present road system, maximum advantage was taken of the following available information:

- the 1977 Regional Roads Needs Study, specifically related to number of lanes and existing right-of-way;
- the 1977 signalized intersection information, including peak-hour vehicle turning movement counts, vehicle classification, signal phasing and intersection geometrics; and
- the designated truck route system and available truck volume data.

Figure 15 illustrates the extent and relationship of the major arterial and highway network within the urban area of the Region. Figure 16 illustrates the existing number of lanes, right-of-way and traffic signal locations for the road system within the area of investigation.

Provincial Highway Network

The major provincial highway system in the area is comprised of the Queen Elizabeth Way, Highway 403, Highway 53, Highway 6, Highway 20 and Highway 8. The Queen Elizabeth Way, Highway 403, Highway 53 and Highway 20 form an outer ring around the major part of the urbanized area. Highway 8 connects with the major urban arterial system to provide a continuous east-west link through the area. Similarly, Highway 6, which meshes with the major arterial system inside the urban area, provides a continuous north-south route through the built-up area.

Major Arterial Road Network: East-West

Within the urban area, the Main Street/King Street one-way system provides the major east-west access to the central area. This route is supported in the west by York Street and Aberdeen Avenue and in the east by Barton Street and the Cannon/Wilson Streets one-way pair. Burlington Street provides the major access from the Queen Elizabeth Way to the Bay Front Industrial Area.

Major Arterial Road Network: North-South

The Niagara Escarpment poses a major physical barrier in providing easily attainable access between the Mountain and the Lower City. From Highway 403 in the west to Highway 20 in the east, seven major crossings have been developed as follows:

- Beckett Drive;
- James Mountain Road;
- the Claremont Access;
- the Jolley Cut;
- the Sherman Cut;
- the Kenilworth Access; and
- the Mount Albion Road.

Beckett Drive, James Mountain Road, and the Jolley Cut connect with the arterial system above and below the Escarpment to provide access primarily to the central area. Similarly, the Claremont Access joins the arterial street system to provide entry to the Central Business District and the Bay Front area from the residential area located above the Escarpment. The Sherman Access provides a similar function to the central Mountain area.

The Kenilworth Access connects the east Mountain residential area predominantly to the Bay Front Industrial Area. As such, it carries a significant proportion of the north-south heavy vehicle movement. Mount Albion Road is becoming more heavily used as the residential

development continues in the east Mountain area and the Saltfleet Community. Highway 403 and Highway 20, as well as providing major links in the area provincial highway system, constitute major commuter routes between Hamilton and the surrounding area municipalities.

4.4.2 Description of Public Transit System

Information related to the present transit system is required to assist in checking the projected range of future transit useage used in traffic forecasting and assessing the impact of alternative location and facility types within the study corridor on transit accessibility and operating costs.

Discussions were held with HSR staff to assemble current data and to gain an appreciation of the planned system expansion. The following information was assembled:

- current passenger volume statistics (Table 3.5); and
- current route information related to hours of service, frequency of service, round-trip mileage and average operating speeds (Table 4.1).

The current routes are displayed in Figure 17.

4.4.3 Major Utilities

The various utility agencies operating in the study area were contacted and have provided information concerning their existing and proposed facilities. The agencies contacted are:

- Union Gas
- Ontario Hydro
- Hamilton Hydro
- Bell Canada
- Region of Hamilton-Wentworth - watermains
  - sanitary and storm sewers
- Trans-Northern Pipe Line Company

Table 4.1

SUMMARY OF 1981 TRANSIT OPERATING STATISTICS
HSR ROUTES WITHIN AREA OF INVESTIGATION

Route	RT Mileage	Peak Vehicle Assignment	Scheduled Speed	Frequency of Service			Weekday Hours of Service
				Peak	Base	Ev'ng	
Fennell	22.1	9	13.3	11	12	15	5:43a-1.31a
Garth	10.3	4	10.1	15	30	30	4:35a-1:25a
Mohawk	12.0	4	11.3	15	20	20	6:05a-12:51a
Sanatorium	12.4	5	12.0	15	30	30	5:18a-1:45a
Upper James*	11.4	8	10.9	8	10	10	5:03a-2:01a
Upper James (C)	8.7	3	12.0	15	--	--	5:32a-9:09a, 1:56p+5:49p
Upper Wellington*	8.3	5	9.9	10	15	15	5:19a-1:32a
Upper Ottawa*	14.7	6	11.9	12	20	30	5:05-1:48a
Upper Kenilworth*	12.4	6	12.1	12	20	30	4:58a-1:51a
Upper Paradise	12.0	4	12.0	15	20	30	5:18a-1:45a
Delaware	21.9	29	11.3	4	7.5	10	5:03a-2:01a
Upper Gage*	13.5	5	11.9	15	20	20	5:03a-2:12a
Barton	15.0	18	9.7	5	5	7.5	5:15a-1:53a
Upper Wentworth*	8.3	5	11.0	10	15	20	5:05a-1:38a
Upper Sherman*	11.5	6	11.6	10	15	20	5:07a-1:57a
King	13.5	20	10.5	4	4.5	8	5:38a-1:53a
Mohawk College	-	2	-	-	-	-	-

RT - Round Trip

* - Denotes Routes Using Jolley Cut

The information provided by these agencies consists of the location and size of existing facilities and expansion proposals.

The information is illustrated in Figure 18. Only major utilities which would have a significant effect on the cost of an alternative if relocation is required are shown. Generally, the major utilities are buried sufficiently deep that they will not conflict with a major road. Areas of major road cut or fill were investigated, in particular, to determine major conflicts.

4.4.4 Railways

The regional offices of both the CNR and CPR (T. H. & B. Railway) were contacted to determine the size and importance of the existing lines and any proposed changes. Each railway has major lines crossing the study area, but could not comment on any plans for change.

The railway lines are of sufficient importance that any arterial or expressway crossing of them should be grade separated. Once a grade separation is proposed, the railways will comment as to the possible implications. The only location where railway sidings may present a problem is in the industrial area in the northeast section of the study area.

4.4.5 Soils

General soils information about this study area was obtained from:

- Hamilton-Wentworth Regional Soils Study
  Golders Associates, June 1976
- Hamilton Area Rapid Transit Study
  Physical Feasibility Report, July 1970

These reports have provided a general overview of the soils in the study area and were used to identify areas which require more detailed information or

which will affect the construction cost of an alternative. The available information related to soil thickness is illustrated in Figure 16.

The study area can be divided into three sections for general soils discussion:

- Above the Escarpment, the bedrock is dolomite overlain by clay and till plains. The bedrock depth tends to be less than 25 feet and in some areas is only 8 feet. This could present additional costs for rock excavation in some areas which require road cut and utility relocation. No problems are anticipated for structure foundations or groundwater drainage.

- Below the Escarpment, the bedrock is Queenston shale overlain by sand, shale plains, beaches and shorecliffs. The depth to bedrock is about 20 feet at the base of the Escarpment and increases to 80 feet at the Lake. Footings placed on bedrock are no problem; however, spread footings on the surface may require more investigation. Groundwater drainage is generally no problem.

- The Escarpment itself consists of weathered dolomite and tallus slopes with extensive groundwater seepage. The tallus slopes could present a stability problem for side hill cuts and are better treated with frontal cuts and fills which may be more expensive. The groundwater seepage along the face of the Escarpment presents a problem of falling rocks. The use of tunnels on the Escarpment has been considered in other projects and requires more detailed investigation if considered on this project.

4.4.6 Floodplain Analysis

The inventory of storm water runoff focused on the Red Hill Creek Valley. The floodplain lands of Red Hill Creek convey the storm flood waters from the watershed through the City of Hamilton to Lake Ontario. These floodplain lands vary from a broad flat valley section of moderate slope above the

Escarpment to a narrow steep raceway through the scarp area. Below the Escarpment, the Valley is rather narrow, steep-sided and of moderate to steep slope. The unconfined passage of flood waters through the Valley would result in a rather uniform depth velocity relationship throughout the reaches above and below the Escarpment.

Unfortunately, there are a number of structures located within the Valley which impede flood flows to such an extent that major runoff events such as Hurricane Hazel would produce depths of water in the Valley varying from 6 feet to 33 feet. Any further encroachment on the rather confined floodway of Red Hill Creek could result in higher design flood levels than those computed by M.M. Dillon for the Hamilton Region Conservation Authority. Existing Valley structures provide some flood peak attenuation as a result of the damming effects of the major hydraulic obstructions located at the Canadian National Railway crossing, the Toronto, Hamilton and Buffalo Railway crossing and the Queenston Road crossing. These structures are not designed to sustain the high waters and hydraulic forces indicated in the Dillon report and their stability during a major runoff event could be critical to the downstream Valley.

The Hamilton Region Conservation Authority had planned to construct a flood control reservoir in conjunction with the proposed east-west roadway. The planned reservoir was located just upstream of the Escarpment spillway. The Authority has purchased much of the land required for the project. The creation of a flood control reservoir would reduce the ponding behind the major hydraulic restrictions previously mentioned.

As the preliminary analysis raised possible concerns regarding the possible encroachment of roadway on the natural floodway in the Valley, additional analysis[27] was carried out. The purpose was to determine if a roadway would adversely effect the flooding along the Red Hill creek Valley during a major storm.

Using the HEC-II computer program developed by the US Corps of Engineers, flow and cross-sectional data from the M. M. Dillon study, a model of the

existing conditions was developed. This was compared in the Dillon results to confirm similar procedures were used. The cross section of the Valley was then adjusted to conform with the proposed roadway embankment. Culverts were inserted at the creek crossings and the revised data was modelled and compared to the flooding levels without the roadway.

The result of the analysis indicated that the roadway embankment would have only a minimal effect on flooding since the controlling elements are the culverts. A minor decrease in the storage volume would occur, but since the section discharges directly into Hamilton Bay, the reduced storage is not of concern.

Importantly, if the existing culverts were to be enlarged at the T.H.&B. embankment and Queenston Road, the flooding elevation within the Valley would be reduced. The potential requirement for artificial armouring of the watercourse due to increased velocities has been recognized in the cost estimates for the roadway construction.

5. ALTERNATIVES AND EVALUATION

This section of the submission details the basis for the development and comparison of reasonable alternative means of achieving the stated purpose of the undertaking as outlined in Section 2.1. It includes an assessment of the alternatives to the undertaking and the various alternative methods of carrying out the undertaking. An overview of the evaluation process is provided in the accompanying illustration.

5.1 SELECTION OF APPROPRIATE PLANNING ALTERNATIVE

Several strategies were identified as possible means of achieving the objectives, including:

- Impact of other road projects;
- Greater use of public transit;
- Non-structural options such as staggered work hours, increased vehicle occupancies, and shifting of non-work traffic from the peak hour;
- Traffic operations improvements;
- Expansion of the existing arterial street system; and
- Construction of new roadways.

The above strategies were grouped into three basic planning alternatives as follows:

- the NO-ACTION Alternative
- the MINOR Alternative; and
- the MAJOR Alternatives.

Transportation Strategies	Planning Alternatives	Selected Planning Alternative	Alternative Route and Facility Types	Result of Preliminary Screening	Result of Detailed Evaluation
• Greater Public Transit Use	NO-ACTION Alternative		Alternative 1		
• Impact of Other Road Projects			Alternative 2	Alternative 2	Alternative 2
• Non-Structural Options to Reduce Peak-Hour Traffic			Alternative 3	Alternative 3	
			Alternative 4	Alternative 4	
			Alternative 5		
			Alternative 6		
			Alternative 7		
			Alternative 8		
			Alternative 9		
• Traffic Operations Improvements	MINOR Alternative		Alternative 10	Alternative 10	
			Alternative 11	Alternative 11	
			Alternative 12		
• Localized Geometric Improvements			Alternative 13		
			Alternative 14		
• Expansion of Existing Arterial Street System			Alternative 15	Alternative 15	
• Construction of New Roadways	MAJOR Alternatives	MAJOR Alternatives			

OVERVIEW OF EVALUATION PROCESS

5.1.1 The NO-ACTION Alternative

The NO-ACTION option is defined as the continued maintenance of existing facilities in combination with the planned expansion of other roads within the Region. Incorporated within this strategy is the possible influence of several non-structural options such as:

- the impact of possible major increases in the rate of public transit use created by a combination of improved services or significantly higher relative costs of auto travel related to fuel and parking costs; and

- reduction of peak travel demand through variable work hours, modified work week, increased car occupancy, car size and shifting of non-work traffic.

Impact of Other Roadway Projects

The Ministry of Transportation and Communications has planned a number of highway improvements both in the Region and in the immediate area surrounding the Region. Thee projects include:

- QEW Skyway Expansion
- Extension of Highway 403 West to Brantford
- Widening of Highway 6 North to Highway 401
- Improvements to Highway 6 South to Nanticoke

In general, these roadway projects will greatly improve the accessibility of the Hamilton-Wentworth Region to adjacent areas. They are not intended to provide improved accessibility internal to the urbanized area of the Region.

Similarly, the planned extension of full GO Transit services to Hamilton will improve accessibility to adjacent areas. However, it will not have a significant impact on the internal transit use within the urbanized area.

Within the planning period to 2001, the Region has initiated the extension and widening of Burlington Street to increase road capacity and accessibility into the Bay Front industrial area. Currently the major widening of Burlington Street is underway between Woodward Avenue and Kenilworth Avenue. This project is due for completion in 1984. The westerly extension of Burlington Street (the Perimeter Industrial Road) to Highway 403 is planned, but is not included in the current capital works program.

All of the above road improvements were incorporated into the road network and therefore recognized in the forecast of traffic volumes. The impact of these projects in providing relief to the Escarpment access roads is limited due to:

- these road and transit projects being designed to serve inter-regional traffic which represents less than 10 percent of the total traffic crossing the Escarpment; and

- the locations of these projects are sufficiently removed from the geographic area of the Escarpment accesses so that their influence in terms of traffic diversion is minimal.

Transit and Non-Structural Options

As outlined in Section 3 - FORECAST OF TRANSPORTATION DEMAND, the projected vehicular volumes have considered the influence of marked increases in public transit use and the non-structural options to reduce peak period travel demand. As a result of the recent rapid transit investigation, public transit will continue to be provided by surface bus and trolley services. Assumptions regarding futher reductions of peak period vehicular traffic through higher transit usage and the greater influence of disincentives to auto use are considered unrealistic.

5.1.2 The MINOR Alternative

The MINOR road expansion alternative is distinguished from MAJOR road expansion options as it may only provide a partial solution to forecast transportation needs while MAJOR options are intended to satisfy the total demand. While the MINOR alternative may produce less transportation benefits, it may also reduce adverse impacts.

Based on the foregoing, the MINOR alternative was defined to include the following:

- the impact of possible increased transit use and other road projects as described under the NO-ACTION alternative;

- operational modifications which may include preferential lanes, traffic control, selective lane additions, and intersection improvements; and

- projects without significant environmental impact, including road widenings. These improvements are within existing or readily available road allowances. All facilities at at-grade arterials.

Consideration of these various projects focused on those which would expand the capacity of the road system crossing the Escarpment; the location of the transportation deficiency. Isolated improvements may be possible. However, because of constraints imposed by the arterial roadway leading to the accesses, the possible capacity cannot be fully achieved.

The Region and the City of Hamilton are continuing a program to make full use of the existing arterial street system. The elements in the program include:

- the removal of curb parking and extending rush-hour stopping restrictions in curb lanes. This program has now been implemented on approximately 90 percent of the major street system;

- the introduction of an extensive one-way street network on both the north-south and east-west streets to increase street capacity;

- the operation of peak-hour reverse-flow lanes where possible on the Mountain access routes; and

- selected intersection improvements to improve operational efficiency and safety.

Studies have been completed to assess the benefits of computer control of traffic signals and a bus priority system. Further restrictions on the movements of large trucks through residential areas and the downtown core are being reviewed.

The program has also included road construction and widenings to increase capacity in key elements of the road systems. These projects included:

- the widening of York Street between Queen and Dundurn Streets to provide capacity in balance with the Wilson/Cannon one-way pair;

- the widening of Upper James Street between Fennell Avenue and Mohawk Road; and

- the major widening of Burlington Street at the eastern entrance to the industrial area.

In total, the program has extended the capacity of the present road system to its practical limit. Maximum advantage has been taken of operational improvements and road widenings at critical points in the system.

The assumed remaining expansion of the present arterial road system is illustrated in Figure 19. The number of projects is extremely limited as the potential to carry out further expansion of the present accesses is considered

unrealistic due, in part, to the physical limitations and the obvious significant disruption which would result. The accompanying photographs of the present accesses underline the validity of this conclusion.

The projects which have a possible impact on the traffic capacity of the Escarpment crossings are described below.

James Street/Arkledun Avenue/St. Joseph's Drive

This project is intended to eliminate the present bottleneck at the base of the Jolley Cut and increase the total capacity of the access by 1,100 vph. This improvement would eliminate the forecast 2001 road deficiency along the Central Screenline. The estimated cost of this improvement totals $1.5M (1979) including property acquisition.

Centennial Parkway

It appears physically feasible to widen Centennial Parkway (Highway 20) between the QEW and Mud Street without significant property acquisition. The project would include the addition of one lane in each direction and the reconstruction of the CN underpass north of Barton Street. The estimated cost of this improvement totals $7.2M (1979) including property. The project would reduce the 2001 projected roadway deficiency in the peak direction on the East Screenline to two equivalent arterial lanes.

5.1.3 MAJOR Alternatives

The MAJOR alternatives encompass the construction of a new roadway to fully meet the stated transportation objectives. These alternatives were distinguished from the other planning alternatives by the following:

- provision of sufficient additional capacity to meet the forecast travel demand;

- requirement for high capital costs for construction; and
- inclusion of potential adverse impacts on the social environment related to dislocation and on the natural environment.

In the development of the MINOR alternative, it was recognized that the James Street/Arkledun Avenue/St. Joseph's Drive improvement represented a cost-effective method of partially expanding the capacity of the existing accesses. Accordingly, it was included in the MAJOR alternative to reduce the scale of the new construction.

The collection and analysis of the relevant data related to the existing and planned development, the natural environment constraint areas, and present infrastructure formed the initial framework for identifying an appropriate geographical area to develop potential MAJOR road expansion alternatives.

The definition of a geographical area of investigation represents an initial screening of options in that alternatives outside this area are not considered. The study area was developed primarily from an assessment by the Study Team of the magnitude of disruption resulting from major roadway construction and the approved transportation policies of Regional Council.

The geographical area must allow for the development of a continuous road connection between Highway 403 and the QEW. The east-west and north-south facilities complement each other. While the major capacity deficiency is forecast in the north-south direction crossing the Escarpment, a high-type facility in the east-west direction is required to attract motorists away from the north-south existing crossings to the new roadway. In addition, an east-west roadway allows the removal of heavy vehicles from existing arterials with abutting residential development, and the orderly development of the residential neighbourhoods in the Mountain Urban Area.

In the north-south direction crossing the Escarpment, the provision of a major roadway between Beckett Drive and the Kenilworth Access is considered non-viable. This assessment is based on the following considerations:

ST. JOSEPH'S DRIVE LOOKING EAST TO JOHN ST.

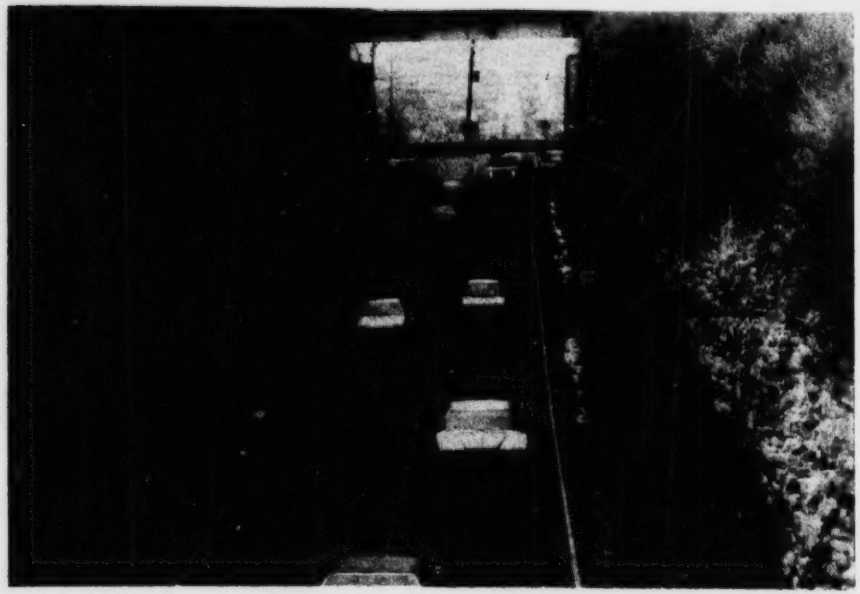
ARKELDUN AVE. LOOKING WEST TO JOHN ST.

ARKELDUN AVE. TOWARD JOLLEY CUT

JOLLEY CUT AT CONCESSION ST.

KENILWORTH AVE. AT QUEENSTON ROAD

KENILWORTH ACCESS AT T.H. & B. RAILWAY UNDERPASS



SHERMAN CUT - LOOKING NORTH

SHERMAN CUT LOOKING SOUTH TO CROCKETT ST.

MT. ALBION LOOKING NORTH AT ESCARPMENT CROSSING

MT. ALBION ROAD LOOKING NORTH TO KING ST.

CENTENNIAL PARKWAY AT QUEENSTON ROAD

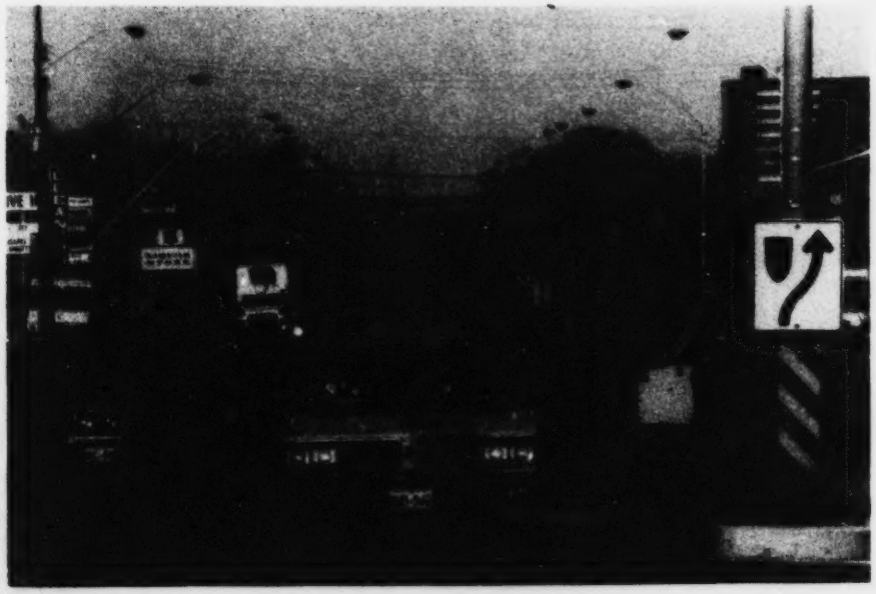
HIGHWAY 20 SOUTH OF KING STREET

DESIGNATED 60M R.O.W. WEST OF UPPER OTTAWA

DESIGNATED 60M R.O.W. EAST OF UPPER OTTAWA

MUD ST. LOOKING WEST FROM MT. ALBION ROAD

MOUNT ALBION ROAD LOOKING NORTH FROM MUD ST.



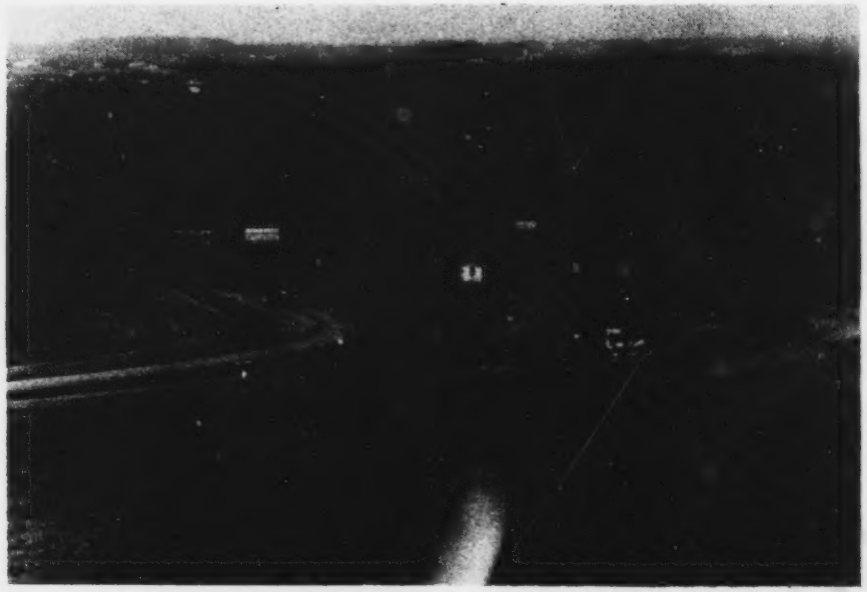
UPPER JAMES ST. LOOKING NORTH AT MOHAWK ROAD

LIMERIDGE ROAD AT KINGFISHER BLVD.
NOTE: DOWNGRADING INTO LOCAL STREET SYSTEM

LIMERIDGE ROAD LOOKING WEST FROM LEGGETT CRESCENT

DESIGNATED 60M R.O.W. LOOKING EAST FROM UPPER SHERMAN

WILSON STREET: LOOKING SOUTH
JUST NORTH OF ESCARPMENT CROSSING



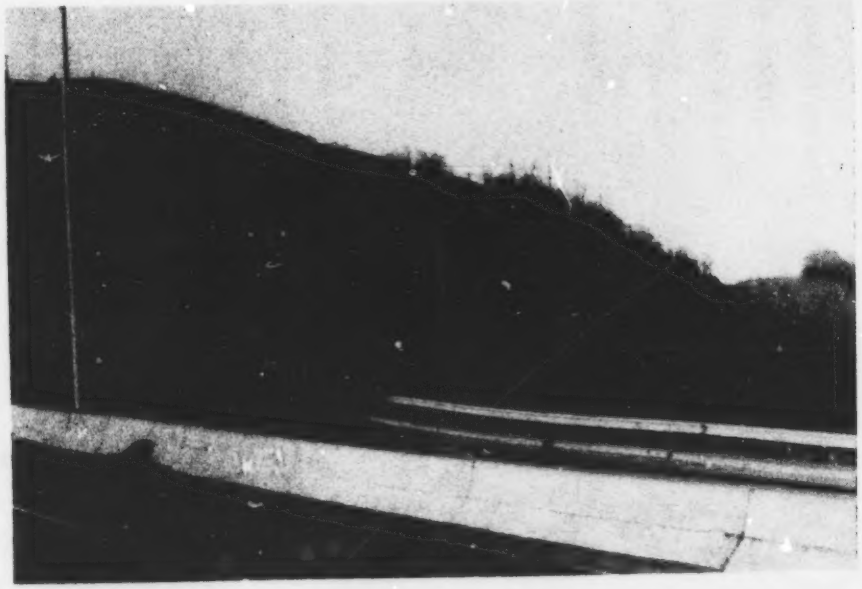
HIGHWAY 403 - LOOKING NORTH FROM MOHAWK ROAD

MOHAWK ROAD LOOKING EAST OPPOSITE OLD MOHAWK ROAD

MOHAWK ROAD AT GARTH ST.

UPPER JAMES: LOOKING TOWARD CLAREMONT ACCESS

CLAREMENT ACCESS LOOKING NORTH
(JOLLEY CUT CROSSING IN BACKGROUND)

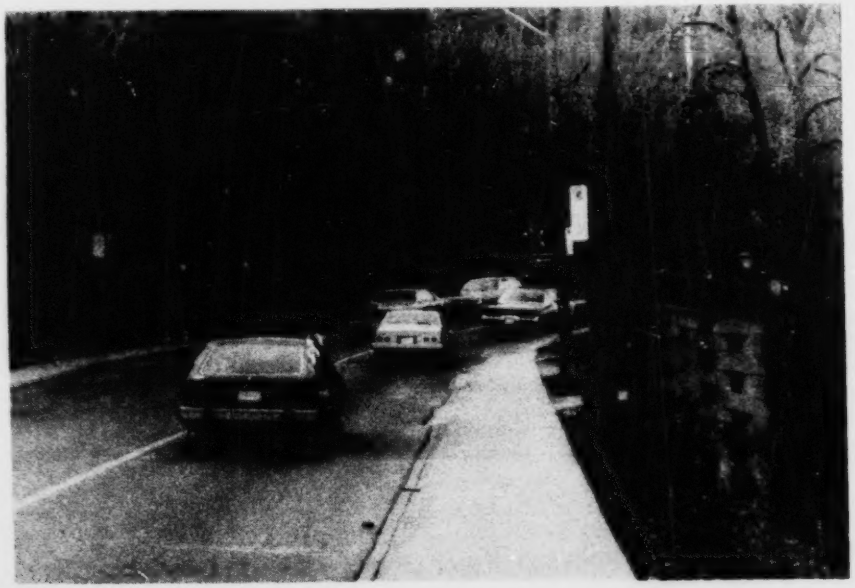


CLAREMONT ACCESS
LOOKING SOUTH TO JOLLEY CUT GRADE SEPARATION

CLAREMONT ACCESS LOOKING NORTH TO VICTORIA STREET

JAMES MOUNTAIN ROAD LOOKING SOUTH FROM INGLEWOOD DRIVE

JAMES MOUNTAIN ROAD LOOKING NORTH AT BROW OF ESCARPMENT (RAMP FROM CLAREMONT ACCESS IN BACKGROUND)



BECKETT DRIVE LOOKING SOUTH FROM QUEEN STREET

BECKETT DRIVE AT BROW OF ESCARPMENT

- the construction of a major new roadway through fully developed residential neighbourhoods would create significant disruption;

- with reference to Section 3.5, the future largest roadway capacity deficiency was projected to be east of the Kenilworth Access; and

- the central Screenline is the location where increased transit ridership will have the greatest potential for reducing auto use. The provision of expanded parallel roadways in the corridor approaching the Central Area could reduce the attractiveness of transit in this corridor.

Given the above, the examination of possible north-south alignments for a new roadway focused on the area located between the Kenilworth Access and Fruitland Road. Again, the disruption of present development was the major consideration in selecting five alternative corridors as described below.

(i) Kenilworth Corridor

This alternative, starting from the east-west facility, would follow the west side of the Red Hill Creek Valley along the face of the Escarpment along the existing CNR tracks. Below the Escarpment, a one-way pair would be provided using Kenilworth Avenue in the southbound direction and Crosthwaite Avenue in the northbound direction. The connection to the Queen Elizabeth Way would be made via Burlington Street.

(ii) Red Hill Creek Valley/Woodward Avenue

This alternative, starting from the east-west facility, would follow approximately the alignment of the existing Mount Albion Road to a point just south of Greenhill Road where it would turn in a northwest direction and would descend into the Valley. The location from here, in the case of a freeway, would largely stay within and follow the Red

Hill Creek Valley before it would connect into the Queen Elizabeth Way at a new interchange. In the case of an arterial, however, it would connect into Woodward Avenue in the vicinity of Queenston Road, joining the Queen Elizabeth Way via the interchange on Burlington Street.

(iii) Highway 20 Corridor

This alternative, starting from the east-west facility (Mud Street), would skirt the Saltfleet Development on the east side and follow the existing Highway 20 alignment joining the Queen Elizabeth Way at the Highway 20 interchange.

(iv) Highway 20 and Red Hill Creek Valley

This alternative, starting from the east-west facility (Mud Street), would skirt the Saltfleet Development on the east side and follow the existing Highway 20 alignment to a point just south of King Street. It would then swing in a northwest direction through largely undeveloped land, to connect into the Red Hill Creek Valley just north of King Street. It would then follow the Red Hill Creek Valley and connect into the Queen Elizabeth Way by a new interchange.

(v) Fruitland Road Corridor

This alternative, starting from the east-west facility just north of Mud Street, would proceed in a northerly direction through basically undeveloped land between Tapleytown Road and Third Road East, to a point just south of the TH&B Railway line. It would then swing in a northeast direction and would connect into a new road east of

Fruitland Road. Below the Escarpment, it would follow an alignment 150 m east of Fruitland Road, joining the Queen Elizabeth Way at the Fruitland Road interchange.

In the east-west direction, again the extent of the established development, together with the committed neighbourhood development plans were the major determinants in the selection of optional roadway corridors connecting Highway 403 with the options in the north-south direction. North of Limeridge Road, the urban development is well established. The construction of a major roadway would create unacceptable disruption. South of Limeridge Road, three possible corridors were identified as follows.

(i) Existing Arterial Expansion (Limeridge Road)

This alternative, starting from the north-south roadway, would follow the protected right-of-way westerly to the vicinity of Upper Ottawa Street and then use the existing Limeridge Road road allowance to Upper James Street. The connection to Highway 403 would be made through the use of Upper James Street and Mohawk Road.

(ii) Limeridge Road Corridor (Protected Right-of-Way)

This alternative, starting from the north-south facility, would largely follow the 60 m right-of-way, which is protected throughout most of its length and positioned immediately south (±120 m) of the existing Limeridge Road. At the west end, it would conect into the existing Mohawk Road, joining Highway 403 at the Mohawk Road interchange.

(iii) Hydro Right-of-Way

This alternative, starting at the north-south facility, would largely follow the existing Hydro corridor immeditely south of the City limits and connect into Highway 403 at a new interchange immediately west of Southcote Road.

The Limeridge Road corridor is an obvious option as significant planning commitments have been made assuming the provision of a major roadway in this location. South of the protected right-of-way to the City limits, partial development of neighbourhoods, including schools, has occurred. The remaining option, which provided a continuous east-west roadway corridor, was the present Hydro right-of-way.

The locations of the selected corridors are illustrated in Figure 20. Various combinations of these corridors formed the basis for the development of alternative methods of carrying out the construction of a new roadway facility.

Roads, in general terms, can be classified or categorized on the basis of differences in traffic service, land access and geometric design features. The MAJOR alternatives within the context of this project were considered to be either freeways or arterials or the combination of both. Rural and urban refer to the predominant characteristics of the adjacent land use.

Freeways are intended to accommodate large volumes of traffic moving at high speeds under free flowing conditions. These conditions, however, can only be provided by grade separated crossings and interchanges. Freeways are expected to carry all types of vehicles, including a relatively high percentage of transport trucks. Only express bus service with no stops is permitted. All freeways should be designated as multi-lane, divided, controlled access facilities, even though they may be developed by staged construction.

Urban arterials are intended to carry large volumes of all types of traffic moving at medium to high speeds. They should desirably have no direct access to development except at signalized intersections. In some instances, however, abutting land access might be unavoidable, e.g., expansion of the existing Limeridge Road. Where signals are closely spaced, they should be interconnected and synchronized to minimize the interference to through movements. Another solution to this same problem is to grade separate some of the intercepting roads with the intention of increasing spacing between intersections. Parking and unloading should be prohibited where they might affect through-movement of traffic, particularly during rush hour. Bus stops should be designed to minimize interference with through traffic movement. Turning lanes may be provided at intersections.

Taking into account the various reasonable combinations of corridor and facility options, 15 alternatives were identified. Most alternatives required some additional arterial improvements for either capacity reasons or to ensure dispersion of traffic in an operationally adequate manner. The alternatives were grouped as given below relative to the assumed north-south facility type and locational option. Each of the 15 alternatives is illustrated in Figures 21, 22, 23 and 24 and compared in Table 5.1.

North-South Corridor	Alternative No.	East-West Corridor
Red Hill Creek Freeway	1	Existing Arterial Extension (Limeridge Road)
	2	Limeridge Arterial
	3	Limeridge Freeway
	4	Hydro Corridor Freeway
Highway 20 Freeway	5	Existing Arterial Expansion (Limeridge Road)
	6	Limeridge Arterial
	7	Limeridge Freeway
	8	Hydro Corridor Freeway
Highway 20 and Red Hill Creek Freeway	9	Existing Arterial Expansion (Limeridge Road)
	10	Limeridge Arterial
	11	Limeridge Freeway
	12	Hydro Corridor Freeway
Fruitland Freeway	13	Limeridge Freeway
Kenilworth Arterial	14	Limeridge Arterial
Red Hill Creek and Woodward Avenue Arterial	15	Limeridge Arterial

Table 5.1

DESCRIPTION OF MAJOR ROAD EXPANSION ALTERNATIVES

Alternative	Estimated Cost of Construction ($M - 1978)[a.]	Number of Homes Required/Affected[b.]	Disruption of Businesses[c.]	Estimated Capacity Deficiency[d.] (Designated Development Capability)	Potential Conflict with Environmental Constraint Areas
1	54.5	35/30	-	Nil	High
2	59.8	65/40	-	Nil	High
3	77.3	120/55	-	Nil	High
4	82.8	105/40	3	Nil	High
5	65.4	100/45	30	35%	Limited
6	69.2	100/45	30	14%	Limited
7	104.3	150/65	30	Nil	Limited
8	109.5	140/40	35	5%	Moderate
9	55.2	85/50	5	35%	Moderate
10	58.7	85/50	5	14%	Moderate
11	93.8	135/70	5	Nil	Moderate
12	99.0	120/55	15	5%	High
13	95.4	135/35	8	2%	High
14	49.4	90/500	25	6%	Moderate
15	48.1	70/-	5	Nil	High

a. See Ref. 3 Appendix D
b. See Ref. 3 Appendix B
c. See Ref. 3 Appendix B
d. See Ref. 3 Appendix A

5.1.4 Assessment of Planning Alternatives

The assessment of the three planning alternatives is summarized in Table 5.2. The conclusion drawn from the comparison was that the NO-ACTION and MINOR alternatives did not represent viable alternatives to the undertaking. The basis for this conclusion is expanded upon in this section of the submission.

The forecast roadway capacity deficiency is the key indicator in estimating the associated impacts under each planning alternative. The projected roadway capacity deficiencies under the NO-ACTION and MINOR alternatives is significant viewed in terms of the assumed influence of higher transit usage, other road projects, and non-structural strategies to reduce peak auto usage. These alternatives would not provide solutions to present environmental issues of traffic nuisance in existing residential areas, the efficiency and safety of goods movement within and through the urban area, vehicle accident rates, and energy conservation.

No improvement is provided in the attractiveness of the planned residential and industrial development south of the Escarpment. In this respect the NO-ACTION and MINOR alternatives are incompatible with the adopted transportation policies of Regional Council as expressed in the Official Plan.

The implications of the comparison provided in Table 5.2 are clear. If development as outlined in the Official Plan is to be accommodated and current transportation deficiencies are to be resolved, construction of a new roadway facility represents the most appropriate planning alternative.

New roadway construction will involve high capital costs for road construction, likely disruption of a portion of the natural environment, and some dislocation of residential properties. While the absolute impact on individual families cannot be ignored, the number of homes required represents approximately 0.3% of the existing households within the Mountain Urban Area.

Table 5.2

SUMMARY OF ASSESSMENT OF PLANNING ALTERNATIVES

Assessment Criteria	Planning Alternatives NO-ACTION	MINOR	MAJOR
IMPACT ON SOCIAL ENVIRONMENT			
• Traffic Nuisance in Residential Areas	Increase	Increase	Reduction
• Homes Required	Nil	Nil	35 - 135
• Safety of Vehicular Travel	No Improvement	No Improvement	Improvement
• Provision of Upgraded Truck Route	No Improvement	No Improvement	Improvement
IMPACT ON ECONOMIC ENVIRONMENT			
• Physical Disruption of Existing Business	Nil	Limited	Nil - 35
• Enhancement of Designated Development	Negative	Negative	Positive
• Effect on Vehicle Operating Costs	Increase	Increase	Decrease
• Capital Cost of Roadway Construction (1978)	Nil	$8.7 M	$48.1 M - $109.5 M
IMPACT ON NATURAL ENVIRONMENT			
• Potential Conflict with Environmental Constraint Areas	Nil	Nil	Limited to High Impact
LEVEL OF ACCESSIBILITY			
• Estimated 2001 Capacity Deficiency			
- West Screenline	24%	24%	Nil
- Central Screenline	6%	Nil	Nil
- East Screenline	56%	30%	Nil
COMPATIBILITY WITH ADOPTED TRANSPORTATION POLICY	Incompatible	Incompatible	Compatible.

An equitable comparison of total costs of the planning alternatives is difficult due to the complexity of the calculation. For a complete comparison, estimates of the following are required for each planning alternative:

- new roadway construction costs;
- roadway maintenance costs;
- vehicle operating costs;
- net costs of public transit services;
- costs related to in-vehicle travel time; and
- indirect costs relted to traffic nuisance and under-utilized infrastructure.

The estimation of the above items of cost are further complicated because of the variation in travel demand being partially a function of the accessibility provided by the transportation system. Considerable evidence has been put forward in Section 3.0 of this submission to support the assumption that travel by public transit cannot be directly substituted for travel by auto. This strong relationship between development and accessibility is the basis for predicting reduced development where deficiencies in roadway capacity are estimated.

However, to avoid the perception that the NO-ACTION and MINOR alternatives represent low cost solutions, a simplified cost analysis was prepared under the assumption of common travel demand. The comparison is provided below. Due to the complexity of estimating absolute costs under each item, relative indices of annual costs were used in some cases.

SIMPLIFIED COST COMPARISON OF PLANNING ALTERNATIVES

Category of Cost	Planning Alternatives NO-ACTION	MINOR	MAJOR
• Capital Cost of Roadway Construction ($ 1978)	Nil	$8.7 M	$48.1 - $109.5 M
• Roadway Maintenance	Minimal Difference Between Alternatives		
• Vehicle Operating Costs Relative to Current Conditions	Increase	Increase	Decrease
• Public Transit Costs			
- Net Annual Operating Cost: 2001 Demand ($1980)	$14.4	$10.9	$8.1
- Estimated Vehicle Capital Cost ($1980)	$30.0	$22.8	$16.8
- Estimated Support Facility Capital Costs	$10.1	$7.7	$5.7

No significant difference can be determined for roadway maintenance as the lane - miles added under the MINOR and MAJOR alternatives represent a small increase (±5%) over the NO-ACTION alternative.

The vehicle operating costs under the NO-ACTION and MINOR alternatives would increase due to the higher level of congestion resulting from "at-capacity" operation. Under the MAJOR alternative, current vehicle operating costs would decrease by virtue of limited-access road facilities provided.

Public transit cost differences have been highlighted by costing the service required to provide the transit passenger demand under each alternative. Total hypothetical transit demand for each alternative is as follows:

Alternative		2001 P.M. Peak-Hour, Peak Direction Passenger Demand
NO-ACTION Alternative	-	9,500 passengers (5400 + 3000 vehicle deficiency x 1.38)
MINOR Alternative	-	7,000 passengers (5400 + 1150 vehicle deficiency x 1.38)
MAJOR Alternative	-	5,400 passengers

Vehicle requirements were estimated for each alternative using current demand - vehicle requirement relationships for the Mountain Urban Area. Operating costs were based on an average annual cost of $95,800 ($1980) per peak vehicle as derived from available H.S.R. data. Capital costs were estimated using a unit cost of $120,000 per vehicle and $40,500 per vehicle for support facilities.

The thrust of the foregoing discussion and analysis is to demonstrate that, under comon travel demand assumptions, new road construction together with reasonable assumptions regarding transit usage can represent a cost-effective alternative. The apparent cost effectiveness of the NO-ACTION and MINOR alternatives is offset to a large degree by higher net transit costs, higher private vehicle operating costs, and greater travel time costs.

5.2 OVERVIEW OF EVALUATION OF MAJOR ROAD EXPANSION ALTERNATIVES

Selection of a particular transportation improvement involves a choice between a set of alternatives. It often requires the consideration of a large number of predicted impacts with widely varying incidence. A decision to favour one alternative over another under such circumstances requires a trade-off among impacts.

The foundation for the evaluation was derived from the three basic principles of decision-making:

- decisions are based on the differences between the available options;
- monetary consequences must be separated from non-monetary impacts such that the cost of achieving a group of intangible benefits and/or disbenefits can be clearly identified; and
- the impact assessment must deal directly with the issues relevant to the project. An understanding of these issues was derived from the public comments received.

Essentially, the evaluation was a process of elimination to allow the major effort to be focused on a limited number of viable, feasible alternatives. A detailed evaluation of all possible options is impractical.

For the comparison of the major road expansion alternatives, the impacts of each alternative were displayed in comparative units under each factor. However, no attempt was made to arrive at an aggregate impact assessment for each alternative.

The evaluation method was structured in two parts; a preliminary screening and a detailed impact assessment. At each stage, basic concerns expressed by the public were considered under the following major areas:

- transportation service;
- social environment;
- natural environment; and
- cost.

The number of indicators considered under each of the major headings was expanded depending on the level of detail required.

5.3 PRELIMINARY SCREENING OF MAJOR ROADWAY EXPANSION ALTERNATIVES

5.3.1 Description of Preliminary Screening Method

The alternatives were compared by applying six factors and associated indicators considered significant in establishing whether or not a given alternative represented a feasible option in terms of its impacts relative to the other schemes. The following is a brief description of the criteria which were used to measure quantitatively or subjectively the impact of each alternative on the factors and/or indicators under consideration.

i) Transportation Service

The MAJOR alternatives were evaluated against the Designated Development Capability transportation requirements. This approach ensured the alternatives were assessed against possible long-term requirements to ideally locate the initial facility for expansion. The initial sizing of the selected option would be based on 2001 forecasts to guard against initial over-sizing of the facility.

The measure of the level of service provided by an alternative was measured by the following indicators:

a) The degree of relief provided to the abutting arterial street system: The level of congestion was measured as a ratio between the residual volume to be carried by the arterial street system located between the Sherman Access and Highway 20 inclusive compared to its estimated capacity. In the case where an alternative replaced an existing arterial, the net capacity for the remainder of the existing arterial system was utilized.

A volume/capacity ratio of 1.0 indicates the residual traffic remaining on the adjacent arterial is equal to the capacity of

arterial network. A volume/capacity ratio of 1.15 suggests the residual volume exceeds the practical capacity of arterial network by 15% and a high degree of congestion would prevail.

b) The diversion of truck traffic from the existing street system to the new roadway option: The analysis examined the location of existing and future major truck generators. An "attractivenes" indicator was derived by multiplying the estimated 24-hour truck movements by major generators and the estimated Designated Development Capability population within three miles of the new roadway. As such, the indicator represents a measure of the reduction of the exposure of residential population to truck movements. The higher the index, the greater the benefit achieved.

c) The degree of reliance placed on achieving high transit useage: As a measure of the degree of reliance placed on transit, the volume/capacity ratio under current transit useage was prepared for arterial street system located between the Sherman Access and Highway 20 under each alternative.

ii) Social Impact

The degree of potential disruption of neighbourhoods and communities caused by the various alternatives was measured by the following four indicators:

a) The number of residential buildings which would be taken and/or affected by each alternative: The estimate was developed from mapping at a scale of 1" = 400 feet with the right-of-way requirements superimposed. A field survey of land uses within or adjacent to the right-of-way formed the basis of the estimate.

b) The number of commercial and industrial buildings which would be taken and/or affected by each alternative: The estimate of the number of businesses affected was carried out using the same precedure described for the residential property impact analysis.

c) The number and types of existing neighbourhoods and communities which would be disrupted by each alternative: The assessment was made considering existing neighbourhood and community boundaries and the Study Team's local knowledge of neighbourhood linkages. The impact on the local business community and disruption during construction was also assessed to reflect the impact on small businesses dependent on local trade and its pattern of neighbourhood connections. The significance of the impacts associated with each alternative was judged subjectively by the Study Team as significant, moderate or low.

d) The number and types of committed future developments which would be affected by each alternative: The assessment was made in terms of both future residential/commercial/industrial development on presently vacant lands and of possible redevelopment from less intensive to more intensive land uses as a result of increased accessibility. The assessment also covered the extent to which planned developments may be reinforced or negated by each alternative. The following existing and planned developments were considered:

- Limeridge Mall
- East Mountain Industrial Park
- Saltfleet Community
- Mountain Neighbourhood Plans
- Ancaster Industrial Park
- Battleridge Subdivision

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The significance of the impacts associated with each alternative was judged subjectively by the Study Team as positive, neutral or negative.

iii) Impact on the Natural Environment

The degree of potential impact on the natural environment caused by the various alternatives, together with possible mitigating measures, was estimated by the following three indicators:

a) Impact on the physical environment: High infiltration areas, surface water and groundwater discharge, water tables, slopes and erosion, subsurface flow direction and floodplains were considered relevant.

b) Impact on biological environment: Vegetation, terrestrial and avian wildlife and aquatic biology were considered as parameters of concern.

c) Impact on scenic resources: Scenic resources are those elements of the natural environment - views, striking topography, and vegetation - which are considered aesthetic or which provide a visual amenity. Existing scenic resources along each alternative were identified based on the inventory provided by the Niagara Escarpment Commission. The visual impact of highway construction on each visual landscape feature was evaluated as to the extent of influence on the surrounding area ranging from extensive in areas of visual prominence to limited in other less prominent areas.

The assessment of each indicator was based on considerations of existing conditions, predicted impacts associated with each alternative, and probability that mitigating measures could successfully be applied.

The significance of the impacts and the probable mitigating measures associated with each alternative for all three indicators were judged subjectively by the Study Team as significant, moderate or low. In assessing the impacts of each alternative on the natural environment features, consideration was given to the fact that the entire area ultimately would be urbanized.

iv) Impact on Recreation

The main area of significant public open space affected by the alternatives is in the Red Hill Creek Valley. The Valley represents a unique open space in the eastern area of Hamilton, both in terms of existing landform and potential park development.

The impact on recreation in the Red Hill Creek Valley was measured by the following four indicators derived from information provided by the City of Hamilton Department of Culture and Recreation.

a) The amount of useable recreation land affected north of King Street: The public open space in the Valley varies in width and the loss of lands for roadway purposes north of King Street would have a far greater impact on recreation because of the narrowness of the Valley to the north. The recreational use of the land in this section would likely be limited to more active pursuits which would be less sensitive to traffic noise and activity. The number of acres of useable recreation land required for the right-of-way for each alternative was measured.

b) The amount of useable recreational land affected south of King Street: South of King Street, the Valley is much wider and appears sufficient for both active and passive recreational facilities. The loss of lands for roadway purposes in this section would likely have a lesser impact on recreation because of the considerable width of the Valley to the south. The number of

acres of useable recreation land required for the right-of-way for each alternative will be measured. The estimated total acreage of useable recreational land is 605 acres.

c) Impact on future use: With portions of the Valley are already developed for active recreational facilities, the majority of the land represents potential active and current passive uses. The potential impact of a road facility in the Valley will limit the potential use of the area as unique, nature-oriented, coordinated open space. While opportunities would still exist for intensive developed recreational facilities, the roadway may intrude upon the present landscape so as to limit its passive and nature-oriented recreational uses.

d) Impact on established recreational facilities: The impact on the existing recreational facilities situated within the Valley (i.e., golf course, playing fields, ski-tows, etc.), that would be physically affected by each alternative, were determined under this criteria.

The significance of the impacts and the probable mitigating measures associated with each alternative for all four indicators were judged subjectively by the Study Team as significant, moderate or low.

v) Capital Cost

The total cost of each alternative was measured by the following two indicators:

a) Construction cost: The construction costs of each alternative include the cost of roads, structures, grading, interchanges and intersections, drainage, lighting, utilities, signing, engineering and contingencies.

The following criteria were used to rate the relative significance of the estimated construction cost.

Any alternative for which the construction cost ($1978) was:

- between $40 and $60 million is reasonable relative to the other alternatives
- between $60 and $80 million is moderately expensive relative to the other alternatives
- over $90 million is very expensive relative to the other alternatives

b) Property cost: The development of a detailed property cost estimate for all the alternatives was found to be impractical. Therefore, the alternatives were judged subjectively as significant, moderately expensive or reasonable in terms of their property costs, using the Study Team's local knowledge of the property implications in terms of land and residential, commercial, industrial and other buildings that would have to be acquired because of road construction.

vi) Cost Effectiveness

To compare the cost effectiveness of the alternatives, an indicator was developed. It represents the ratio of the peak hour peak direction traffic for the Designated Development Capability attracted by each alternative to the corresponding construction costs. The more traffic attracted by an alternative at a lesser cost, the more cost effective the alternative was considered to be.

5.3.2 Preliminary Screening of Major Roadway Expansion Alternatives

The application of the preliminary screening analysis under the six factors of transportation service, social impact, natural environment impact, recreation, cost and cost effectiveness is summarized in Figure 25. The intent was to screen out those alternatives which offered a relatively low level of transportation service to meet acceptable standards and/or which created severe impacts on the social, natural or economic environment. The basic rationale for the elimination process was to delete alternatives which, by virtue of their location and/or type, did not meet the basic objective of accommodating future travel demand, and in addition created significant disruption to people, the natural environment, and financial resources. This procedure was particularly valid when other options fulfilled the objective while causing less severe disruption.

The comparative analysis outlined in Figure 22 clearly indicated **Alternatives 1, 5, 6, 7, 8, 9, 12, 13 and 14** should be eliminated from further consideration. The locational and facility options which were eliminated through the deletion of the above alternatives are highlighted below with an asterisk.

North-South Study Area	East-West Study Area
*Kenilworth Avenue Arterial	*Existing Limeridge Road
Red Hill Creek/Woodward Arterial	Arterial - Limeridge Corridor
Red Hill Creek Freeway	Freeway - Limeridge Corridor
Highway 20/Red Hill Creek Freeway	Freeway - Hydro Right-of-Way
*Highway 20 Freeway	
*Fruitland Road Freeway	

The basis for the elimination of these four components is highlighted in the remainder of this section.

Kenilworth Avenue (Alternative 14)

Expansion of Kenilworth Avenue is representative of the impact of upgrading any of the existing north-south arterials. This alternative, by replacing the existing Kenilworth Avenue has, in fact, reduced the overall capacity of the existing street network by the capacity of Kenilworth Avenue. While not being capable of accommodating future traffic or providing adequate relief to the existing street system as well as some of the other alternatives, the social disruption renders this option unacceptable. A great number of homes and businesses would have to be acquired. The most severe impact would be felt by those residents who would remain adjacent to the facility with little or no opportunities for mitigation.

Highway 20

Highway 20 is an existing four lane, at-grade facility. By superimposing a six lane depressed freeway, supplemented by service roads on both sides along the existing Highway 20 (Centennial Parkway) alignment, the capacity of the residual street network would be reduced by two arterial lanes in the peak direction. This proposal, in fact, would provide the least capacity, flexibility and relief to the existing arterial street system amongst all the alternatives. It would require the acquisition of a large number of homes and businesses, and a total of 700 jobs would be affected. Although service roads would be provided to maintain access to the remaining businesses, the accessibility to these businesses would be severely disrupted. Access to schools, local shopping and service establishments would be significantly altered. The introduction of service roads would increase the flow of the traffic on the local residential streets.

However, the major community disruption would occur during the approximate 3 year construction period. Because of the high traffic volumes presently utilizing this facility, it would be difficult to maintain an acceptable traffic flow during construction. Vehicles attempting to avoid this area would undoubtedly increase traffic volumes on the local residential streets adjacent

to Centennial Parkway. Based on the foregoing analysis, the Highway 20 alternatives of:

Alternative 5	Highway 20 - Existing Arterial Expansion
Alternative 6	Highway 20 - Limeridge Arterial
Alternative 7	Highway 20 - Limeridge Freeway
Alternative 8	Highway 20 - Hydro Corridor Freeway

were rejected. In summary, these alternatives do not provide adequate relief to the existing arterial street network; they create severe community disruption both during and after construction; and they are considerably more expensive to construct in the north-south direction than the other alternatives.

Fruitland Road Freeway

This option **(Alternative 13)** was eliminated predominantly for being inadequate to accommodate future travel demand, its impact on the natural environment, the out-of-way travel introduced with the additional operating associated costs involved and for being the least cost effective amongst all the alternatives.

Existing Limeridge Road (Alternative 1, Alternative 5 and Alternative 9)

This improvement would not provide a sufficiently attractive route to relieve the present north-south Escarpment crossings. In addition, a major increase in traffic along Limeridge Road would effectively shift the current problems along Mohawk Road to Limeridge Road without providing any improvement in the continuity in connecting the major east-west facility to Highway 403. There would be little or no opportunities for mitigation for the adjacent residential developments.

Based on the Phase 2 preliminary evaluation, it was recommended that **Alternatives 2, 3, 4, 10, 11 and 15** be carried into the detailed evaluation phase. These alternatives offer flexibility in meeting the range in future

traffic volumes while providing cost-effective solutions. The possible undesirable impacts associated with these schemes appear to offer opportunity for mitigating measures to be successful in minimizing the negative impacts. In addition, the selected options appear to best reinforce the development established in the Region's Official Plan.

5.4 DETAILED COMPARISON OF SHORT-LISTED MAJOR ROADWAY EXPANSION ALTERNATIVES

Based on the preliminary screening, Alternatives 2, 3, 4, 10, 11, and 15 were retained for more further detailed investigation and evaluation.

5.4.1 Description of Short-Listed Major Roadway Expansion Alternatives

Alternatives 2 and 3

The description of these alternatives is combined as they both incorporate a freeway in the Red Hill Creek Valley. Under Alternative 2, an arterial would be provided in the protected Limeridge corridor, while a freeway is assumed under Alternative 3.

In both alternatives, a freeway would extend from the Queen Elizabeth Way at a new interchange and would stay within and follow the Red Hill Creek Valley to a point just north of Greenhill Avenue. It would then ascend from the Valley and run parallel to the existing Hydro right-of-way and then follow existing Mount Albion Road to connect with the east-west facility. The east-west facility would follow the 60 m right-of-way, which is protected throughout most of its length and positioned immediately south (±120 m) of the existing Limeridge Road. At the west end, it would connect into existing Mohawk Road, joining Highway 403 at the Mohawk Road interchange.

Alternative 4

Under this alternative, the north-south freeway would extend from the Queen Elizabeth Way similar to Alternatives 2 and 3. Following the Red Hill Creek Valley to a point just north of Greenhill Avenue, it would ascend from the Valley similar to Alternatives 2 and 3, connecting into the east-west facility

adjacent to the Hydro corridor. The east-west facility would follow the existing Hydro corridor immediately south of the City limits and connect into Highway 403 at a new interchange west of Southcote Road.

Alternatives 10 and 11

The description of these alternatives is combined as they both incorporate a freeway in the north-south corridor.

In both alternatives, a freeway would extend from the Queen Elizabeth Way and would follow the Red Hill Creek Valley to a point just north of King Street. The freeway would swing in a southeast direction through largely undeveloped land to connect into Highway 20 just south of King Street. It would then follow the existing Highway 20 alignment, skirting the Saltfleet Development on the east side and connect with the east-west facility located in the Mud Street right-of-way.

Under Alternative 10, the east-west facility would be an arterial, while a freeway is assumed under Alternative 11. The east-west facility would follow the 60 m right-of-way, which is protected throughout most of its length and positioned immediately south (120 m) of the existing Limeridge Road. At the west end, the roadways would connect into the existing Mohawk Road, joining Highway 403 at Mohawk Road interchange.

Alternative 15

This alternative incorporates an arterial in both north-south and east-west corridors. In the north-south corridor, an arterial road would extend from a reconstructed Burlington Street/Woodward Avenue interchange, and would follow the existing Woodward Avenue alignment to Melvin Avenue, where it would turn in a southeast direction and descend into the Valley. From this point, the road remains within the Valley to a point just south of Greenhill Avenue, where it would ascend from the Valley following the alignment of the

existing Mount Albion Road. The east-west facility would follow the 60 m right-of-way, which is protected throughout most of its length and positioned immediately south (120 m) from the existing Limeridge Road. At the west end, it would connect into the existing Mohawk Road, joining Highway 403 at a reconstructed Mohawk Road interchange.

Alternative 15 also includes the widening of Highway 20 to six lanes throughout its entire length, from the Queen Elizabeth Way to its intersection with Mud Street, and the extension of Brampton Street easterly across the Red Hill Creek Valley to connect with Highway 20 just south of the Queen Elizabeth Way. These adjacent arterial improvements are required to provide sufficient capacity to provide for the forecast traffic volumes.

5.4.2 Detailed Impact Assessment Method

The surviving alternatives from the preliminary screening were subjected to a detailed comparison using an expanded technique. The initial step in the evaluation is the selection of factors to ensure both comprehensiveness and relevance to the project. The evaluation factor identification was derived directly from the following issues raised through the public involvement program:

- The extent of support given to the proposed Regional development plan through improved accessibility to jobs, and improved distribution of goods and services.

- The concern of traffic congestion and increased truck traffic on existing residential streets.

- Disruption of established neighbourhoods, including through traffic movements, noise, effect on property values by virtue of road construction near existing homes, pedestrian safety and local access.

- The reliance on the degree to which improved public transit services can reduce the requirement for expanding the road system.

- The impact on open space, recreational facilities, scenic resources and the natural environment, created by the road construction.

- The engineering feasibility of construction within the Red Hill Creek Valley related specifically to additional Escarpment crossings and the impact on the floodplain.

On the basis of the above-noted issues, the Study Team identified the following 16 factors for the evaluation of the short-listed major roadway expansion alternatives.

1.	Number of Homes to be Acquired	The number of homes directly affected by the construction of the alternative was estimated using current 1" - 400' aerial photography with the right-of-way superimposed. This was supplemented by field surveys and detailed base mapping within the City of Hamilton illustrating land use and buildings.
2.	Noise	The noise impact of traffic was based on the Ministry of Transportation and Communications Noise Prediction Method. Information on average daily traffic, truck volume percentage, gradient of roadway, and the contour of adjacent lands was obtained. The mitigating effect of noise barriers was accounted for in the calculations. The result of the method yield an estimate of the average level of noise generated during a 24-hour period.

The Ministry of Environment has recommended a 24-hour level of 55 dB(A) as being appropriate for new residential subdivisions. This was considered an appropriate standard to measure the significance of the impact. On this basis, those homes exposed to a 24-hour noise level in excess of 55 dB(A) were mapped. Significant slope conditions and the barrier effect of adjacent buildings were taken into consideration.

3. Visual Intrusion

In order to quantify the potential visual intrusion, a distance of 400 m either side of the road facility was selected as the impact area. In situations where the alternative involved only a widening of an existing road facility, only those homes not previously within 400 m were counted. Sections where berms would entirely screen the roadway from adjacent development were excluded.

In addition, only the homes remaining after construction of the alternative were counted. This explains the reduced impact of the alternatives incorporating a freeway facility in the East-West Limeridge Corridor.

4. Regional Accessibility

The indicator selected to assess regional accessibility was the population within 10-minute, 15-minute, and 20-minute travel time during the P.M. peak hour of selected employment and activity centres. The rationale was that the alternative which

exhibited the highest overall population within these travel times offered the highest level of regional accessibilty. To indicate the absolute relative accessibility, the population within a 20-minute travel time at the Designated Development Capability was used.

An accessibility index was prepared by dividing the sum of the products of population and employment by the sum of the employment of each employment/activity centre. The difference between the alternatives was measured in relation to the 20-minute accessibility index.

5. Impact on Adjacent Arterial Road System

This factor provided an indication of the degree to which the volume of traffic on the parallel arterial roads was affected by each alternative. The indicators selected included:

- % increase in total traffic under the Designated Development Capability.
- % reduction of truck traffic under the Designated Development Capability from Kenilworth Avenue, Mohawk Road, Upper Ottawa Street.
- effect on neighbourhood accessibility due to the modification to the local street network under each alternative.

6.	Impact on Recreational Land	Present recreation facilities affected and the area of potential open space recreational land directly displaced or rendered unsuitable through severance or noise impact.
7.	Air Quality Impact	Carbon Monoxide (CO) has been found in studies of air quality to exceed recommended levels at distances from the source consistently in excess of the distances for other pollutants. On this basis, the initial evaluation projected CO levels under the Designated Development Capability conditions for the most heavily travelled section of the six alternatives. The Air Resources Branch of the Ministry of the Environment carried out the projection of CO levels taking into account traffic volume, speed of traffic, and the percentage of truck traffic. The significance of the results was established in relation to the MOE "Desirable Ambient Air Quality Criteria of 30 p.p.m. concentration of CO over a one-hour period."
8.	Impact on Established Business	The indicators of impact selected were the number of businesses required and the amount of employment related to the affected businesses. Short-term impacts on businesses during construction were not included. The impact on highway-related businesses due to the diversion

		of traffic was not considered as the through traffic component was projected to be less than 10 percent.
9.	Property Tax Impact	The estimate of loss of tax revenues was calculated by multiplying the average assessed value with the number of homes required under each alternative. The significance of the loss was indicated by expressing the estimated loss as a percentage of the total municipal assessment.
10.	Development Potential	A subjective rating based on the support/non-support provided to the following selected major development proposals • East Mountain Industrial Park • Limeridge Mall • Saltfleet Community • Battleridge Subdivision
11.	Natural Environment	Subjective rating based on principal criteria of hydrology, hydrogeology, soils, vegetation, wildlife, and aquatic biology. The acres of environmentally sensitive lands impacted were calculated.
12.	Scenic Resources	The assessment of existing scenic resources, the impacts of road construction, and the potential for mitigation was based on "The Landscape Evaluation Study - Niagara

Escarpment Planning Area" (Niagara Escarpment Commission, April, 1976).

The areas of attractive scenic resources are closely associated with the Niagara Escarpment and the Red Hill Creek Valley open space area. As a result, areas of concern tend to coincide with the environmentally sensitive areas and open space resources.

The analysis of the identified scenic resources provided a subjective assessment of the likely impact of road construction.

13. Flexibility

The flexibility of the alternatives to accommodate increases in traffic volumes created by either the assumed rates of transit usage not being attained or possible changes in the amount or location of homes and jobs. The indicator used to measure flexibility was the ratio of the total peak hour traffic crossing the Escarpment between the Sherman Cut and Highway 20 to the proposed road network capacity under the current rate of transit usage.

14. Potential Rate of Accidents

Based on current MTC statistics and City of Hamilton statistics, indices of the potential relative rate and severity of vehicle accidents were prepared. For freeways, a potential accident rate of 1.0 per million vehicle kilometres is representative of provincial freeways. For major controlled-acess

roadways, a potential accident rate of 2.0 is representative compared to a potential accident rate of 5.0 for uncontrolled-access urban arterials. The potential accident rate per million vehicle kilometres was estimated considering the mix of freeway and arterial components within each alternative.

15. Service to Truck Traffic

The projected daily volume of trucks at the Designated Development Capability was estimated for each alternative using current truck origin-destination information. The estimated daily volume was used as the indicator of the relative attractiveness of the alternative to truck traffic. In addition, the number of at-grade intersections was used as an indication of relative operating costs.

16. Impact on Transit Service

A subjective rating was prepared considering the degree of compatibility with policy to encourage higher transit use and the possible interference of the facility with the planned expansion of the surface bus routes.

5.4.3 Evaluation of Short-Listed Major Roadway Expansion Alternatives

A detailed impact assessment was carried out for each alternative under the 16 evaluation factors described in Section 5.4.2. The summary of the impact assessment is given in Table 5.3.

Once the impact assessment was completed, the evaluation process focused on the differences between the options. It was recognized that each of the alternatives produced negative impacts on one or more segments of the environment.

Table 5.3

SUMMARY OF IMPACT ASSESSMENT: SHORT-LISTED MAJOR ROADWAY ALTERNATIVES

Factor		Major Roadway Expansion Alternative					
		2	3	4	10	11	15
1.	Number of Homes	93	145	121	131	183	136
2.	Noise	42	125	132	31	70	101
3.	Visual Intrusion	1,270	591	1,096	1,255	660	1,370
4.	Regional Accessibility						
	- Population within 20-Minute Travel Time	326,900	347,200	317,100	290,100	304,900	309,800
	- Accessibility Index	1.16	1.25	1.11	1.0	1.06	1.0
5.	Community Impact						
	- % Traffic Increase on Arterials	Nil	Nil	20%	10%	10%	45%
	- % Reduction of Truck Traffic	40%	45%	40%	40%	40%	35%
	- Neighbourhood Accessibility	Nil	Nil	Nil	Nil	Moderate (Saltfleet Community)	Major (Woodward Avenue)
6.	Recreation						
	- Existing Facilities	Minor	Minor	Minor	Nil	Nil	Minor
	- Open Space Land (Acres)	240	240	240	141	141	132
7.	Air Quality	Under all alternatives, the CO concentration would only exceed 6 p.p.m., 1% of the time. Maximum would be 18 p.p.m. within r.o.w.					
8.	Business Displaced	-	-	4	6	6	3
	- Employment	-	-	(20)	(37)	(37)	(20)
9.	Property Tax	Loss of property tax revenue less than 0.4% of total.					

Table 5.3
SUMMARY OF IMPACT ASSESSMENT: SHORT-LISTED MAJOR ROADWAY ALTERNATIVES
(continued)

Factor	Major Roadway Expansion Alternative					
	2	3	4	10	11	15
10. Development Potential						
- East Mountain Industrial Park	Positive	Very Positive	Very Positive	Positive	Very Positive	Positive
- Limeridge Mall	Positive	Very Positive	-	Positive	Very Positive	Positive
- Saltfleet Community	Positive	Very Positive	Positive	Positive	Positive	Positive
- Battleridge Subdivision	Nil	Nil	Nil	Negative	Negative	Nil
11. Natural Environment	Very Severe	Very Severe	Very Severe	Severe	Severe	Severe
(Acres of Environmental Constraint Areas)	(490)	(490)	(840)	(400)	(400)	(400)
12. Scenic Resources	Severe	Severe	Severe	Moderate	Moderate	Severe
13. Flexibility (Index)	1.09	1.07	1.12	1.16	1.13	1.20
14. Potential Accident Rate	2.0	1.0	1.5	2.2	1.0	4.0
15. Service to Trucks						
- Volume	2,300	2,900	2,000	2,000	2,500	2,200
- At-grade Intersections	9	-	-	15	-	17
16. Impact on Transit	Positive	Positive	Positive	Positive	Positive	Positive
Cost ($M) - 1979	80.0	106.1	110.4	84.3	121.5	65.2

To assist in the evaluation, the comparison was carried out in successive stages. Each stage reduced the number of alternatives. Consistent with the decision-making process, the comparison focused on the difference between the options. Those factors which indicated little or no difference between the alternatives were dropped, since these factors did not assist in highlighting differences between the alternatives.

The impact assessment given in Table 5.3 suggested the impact of the roadway expansion alternatives was common for the following factors:

3.	Visual Intrusion	The difference between the alternatives is marginal and, due to the extensive landscaping and berming incorporated, the absolute impact is considered small.
7.	Air Quality	The analysis indicates the concentration of vehicle emissions is well below the acceptable standard and would be contained within the right-of-way.
9.	Property Tax Impact	The loss of property tax revenue from the right-of-way lands used for road construction would be minimal under all alternatives.
16.	Transit Service	The alternatives were judged compatible with the policy of encouraging greater use of transit and with the desirable expansion of the surface bus routes.

The impact assessment was then adjusted to account for the deletion of the above factors. The adjusted tabulation is outlined in Table 5.4.

A review of Table 5.4 clearly indicates that **Alternatives 4 and 15** are the two least desirable alternatives on the basis of their impacts on a number of significant factors.

Alternative 4 affects the greatest number of homes under noise impact, displaces as great an amount of open space lands, affects the largest amount of environmentally-sensitive land and creates a relatively severe impact on the scenic resources. In brief, there are other alternatives available which create less severe impact on the environment with substantial capital cost savings.

Alternative 15 impacts each of the areas of the environment highlighted by the evaluation factors to an equal or greater degree than other alternatives. The most significant benefit is its least cost. However, the benefits in terms of increased accessibility, reduced community disruption, lower accident potential and transportation flexibility afforded by the other alternatives available were judged as outweighing the cost differences.

The conclusion reached was supported by the public response to the questionnaire distributed at the public information centres. As such, **Alternatives 4 and 15** were dropped from further consideration.

The second stage of the evaluation focused on the remaining four alternatives, namely, **Alternatives 2, 3, 10 and 11.** Alternatives 2 and 3 are the same location-wise; the difference is the east-west facility, being an arterial road under Alternative 2 or a freeway under Alternative 3.

Similarly, Alternatives 10 and 11 are the same location wise; the difference again is the east-west facility. Under Alternative 10, an arterial roadway is assumed in the protected corridor south of Limeridge Road, while a freeway is incorporated in this east-west location under Alternative 11.

Table 5.4

ADJUSTED COMPARISON OF SHORT-LISTED OPTIONS

Factor		Option 2	3	4	10	11	15
1.	Number of Homes to be Acquired	93	145	121	131	183	136
2.	Noise (Number of Homes)	42	125	132	31	70	101
4.	Regional Accessibility within 20-minute Travel Time						
	- Population	326,900	347,200	317,100	290,100	304,900	309,800
	- Accessibility Index*	1.16	1.25	1.11	1.00	1.06	1.00
5.	Community Impact						
	- % Increase in Traffic on Arterials	Nil	Nil	20%	10%	10%	45%
	- % Reduction of Truck Traffic	40%	45%	40%	40%	40%	35%
	- Neighbourhood Accessibility	Nil	Nil	Nil	Nil	Moderate	Major
6.	Impact on Recreation						
	- Existing Facilities	Minor	Minor	Minor	Nil	Nil	Minor
	- Open Space Lands	240	240	240	141	141	132
8.	Number of Businesses to be Acquired (Employment)	- (-)	- (-)	4 (20)	6 (37)	6 (37)	3 (20)
10.	Development Potential Rating	Better	Best	Good	Good	Better	Better
11.	Natural Environment (Acres)	Very Severe (490)	Very Severe (490)	Very Severe (840)	Severe (400)	Severe (400)	Severe (400)
12.	Scenic Resources	Severe	Severe	Severe	Moderate	Moderate	Severe
13.	Flexibility** (Index)	1.09	1.07	1.12	1.16	1.13	1.20
14.	Potential Rate ** of Accidents (Index)	2.0	1.0	1.5	2.2	1.0	4.0
15.	Service to Truck Traffic						
	- Volume	2300	2900	2000	2000	2500	2200
	- At-grade Intersections	9	-	-	15	-	17
	COST ($M) - 1979	80.0	106.1	110.4	84.3	121.5	65.2

* A larger index indicates greater accessibility provided
** A larger index indicates lower flexibility to meet demand
*** A larger index indicates higher potential rate and severity of accidents

As a result, the next stage of the evaluation focused on the relative merits of a freeway or an arterial roadway in the Mountain East-West Corridor. To evaluate this option, a paired comparison of **Alternative 2 vs Alternative 3** and **Alternative 10 vs Alternative 11** was prepared. To simplify the comparison further, all factors which indicated little or no difference between the alternatives were deleted. The paired comparison of the two groups of alternatives is outlined in Table 5.5.

Table 5.5

PAIRED COMPARISON OF FREEWAY VERSUS ARTERIAL IN EAST/WEST CORRIDOR

Factor		2 vs 3		10 vs 11	
1.	Number of Homes Acquired	93	145	131	183
2.	Noise (Number of Homes)	42	125	31	70
4.	Regional Accessibility (Index)	1.16	1.25	1.00	1.06
10.	Development Potential	Better	Best	Good	Better
13.	Flexibility (Index)	1.09	1.07	1.16	1.13
14.	Potential Rate of Accidents (Index)	2.0	1.0	2.2	1.0
15.	Service to Truck Traffic				
	- Volume	2300	2900	2000	2500
	- At-grade intersections	9	-	15	-
	COST ($M) - 1979	$80.0	$106.1	$84.3	$121.5

The major differences between the alternatives with regard to the various evaluation factors are as follows:

- the construction of a freeway will require a greater number of properties due to the construction of interchanges as opposed to at-grade intersections on an arterial.

- due to the greater volume of traffic attracted to the freeway alternatives, a slightly larger number of homes will be affected by noise, but in relative terms the difference is minor.

- the accessibility to work, development potential, and flexibility to accommodate projected traffic demand would be slightly improved under the freeway options; however, the differences are marginal.

- the potential rate and severity of accidents is lower on a freeway facility versus a controlled access arterial. In an absolute sense, when the accident rate is compared to the rate on the existing arterial street system, the freeway would result in an 80 percent reduction, while the controlled access arterial would achieve an approximate 60 percent reduction.

- the service to truck traffic with a freeway would be superior due to the free flowing characteristics. In an absolute sense, the difference relates to exposing truck traffic to an additional 10 to 15 at-grade intersections. With proper signal progression, the effect can be offset to a large extent and thus this factor is not considered significant in the choice between the two facility types.

As a result of the preceding analysis, the Study Team did not feel the benefits offered by a freeway facility in the east-west corridor compensate for the significant difference in construction costs. However, the Study Team believed the protection of property for the eventual upgrading from an arterial to a freeway facility represented sound planning and was justified.

As a result of the Stage Two evaluation, **Alternatives 2 and 10** were retained for final evaluation. In the evaluation of these remaining two alternatives, the analysis focused on highlighting the differences.

In both alternatives, the east-west component is common. While the north-south facility is a freeway in both cases, they differ in location as illustrated in Figure 26. In fact, the difference focuses on the optional routes between the intersection of Mount Albion Road and Mud Street, and the crossing of the Red Hill Creek Valley at King Street.

In reviewing the comparison between Alternatives 2 and 10 provided in Table 5.4, three factors indicate small or insignificant differences, and have therefore been deleted.

Factors to be Deleted		Rationale for Deletion
2.	Noise	Eleven more homes are affected under Alternative 2, but the magnitude of the noise impact is a maximum of 3 dBA above the acceptable level of 55 dBA.
14.	Potential Rate of Accidents	The index given is slightly higher for Alternative 10 since the major roadway connecting the QEW and Highway 403 has a greater length of arterial roadway. But, the actual difference is 0.6 miles of arterial.

15. Service to Truck Traffic — Alternative 2 is rated higher as it will attract an estimated additional 15 percent in the daily truck traffic compared to Alternative 10, and would have six fewer signalized intersections. However, the absolute difference is not considered significant in comparing the alternatives.

Table 5.6 displays the comparison of the two alternatives accounting for the deletion of the factors listed above and the impacts between Mount Albion Road and King Street. The table focuses on the critical differences between the two alternatives and clearly identifies the trade-offs required to reach a decision.

In reviewing the comparison given in Table 5.6, the trade-offs between the two alternatives was clear. Alternative 2 was preferred under considerations of least community disruption, improved transportation services and, to a lesser extent, development potential and capital cost of construction. Conversely, Alternative 10 was preferable, with respect to the impact on the King's Forest Park recreation/open space, natural environment and scenic resources.

5.5 SELECTION OF PREFERRED ALTERNATIVE

The trade-offs reduce to balancing the impacts on the social and economic environment against those effects on the natural open space environment. However, in reaching a technical decision, the Study Team recommended Alternative 2 be retained for detailing in Phase 4 of the project.

In making this recommendation, the Study Team was influenced by the following additional considerations over and above the differences highlighted in Table 5.6.

Table 5.6

DETAILED COMPARISON OF ALTERNATIVE 2 AND ALTERNATIVE 10

NORTH/SOUTH CORRIDOR

BETWEEN MOUNT ALBION ROAD AND KING STREET

	Alternative	
	2	10
Community Disruption		
• Homes to be Acquired	9	47
• Business to be Acquired	-	6
• Increase in Traffic on Adjacent Streets above Current Volume	Nil	10%
Transportation Services		
• Regional Accessibility*	1.16	1.00
• Flexibility to Meet Demand under Low Transit Useage**	1.09	1.16
Impact on Development Potential	Better	Good
Upper Red Hill Creek Area		
• Recreation/Open Space	162 acres	48 acres
• Environmentally Sensitive Areas	162 acres	48 acres
• Scenic Resources	Escarpment Crossing at Mount Albion Rd.	Escarpment Crossing at Highway 20
COST ($M) - 1979	$80.0M	$84.3

* A larger index indicates greater accessibility provided

** A larger index indicates lower flexibility to meet demand

Reduction in Through Traffic

One of the current issues which this project was intended to resolve was the increasing traffic along Mount Albion Road. This problem has increased in recent years to the concern of the local residents both in terms of noise and pedestrian safety. Alternative 2 successfully eliminates this problem while it would persist under Alternative 10.

Expansion Capability

Future growth beyond the study period may require the conversion of the east-west facility to a freeway standard. This conversion would be at least $11.0M more expensive with Alternative 10 than with Alternative 2. In addition, the conversion of Mud Street to a freeway would create significant community disruption during construction and prolonged effects on the Saltfleet Community due to the re-orientation of traffic on the local internal street system.

Flexibility

The continuity of Highway 20 as a major north-south arterial would be maintained with Alternative 2 providing additional flexibility to accommodate traffic demand if and when required. In addition, Alternative 2 provides significantly more capability to meet future traffic demand should sufficient public transit demand not be achieved or the investment in significant improvements in transit be delayed due to restricted financial resources.

Facility User Costs

The difference in user costs for travel between the Mountain area and the activity areas below the Escarpment under each of the alternatives is significant. The added travel distance under Alternative 10 is 5 km greater than Alternative 2.

At current average fuel consumption of 6.7 km/L, the annual cost difference by 2001 would amount to $5M. If significant improvements in fuel efficiency as forecast* are realized, i.e., 11.7 km/L, the difference would amount to $3M annually.

Potential for Successful Mitigating Measures

The effects of implementing Alternative 2 on the natural environment, open space/recreational area and scenic resources can be reduced by good design, construction, and operating practices. All of the above environments are interrelated. A deterioration in one negatively affects the remaining two. With the construction of Alternative 2, the major environmental concerns relate to the impacts on the physical system, vegetation and wildlife.

Alterations to the physical system related to siltation, contamination of surface watercourses, flooding hazard, groundwater quality, erosion and the disturbance of soil properties can be significantly reduced through careful construction techniques. The construction costs have made allowances to significantly reduce the present flood hazard in the Valley through the replacement of the existing undersized drainage structures.

Impacts on vegetation may be offset by minimizing the right-of-way clearance, replanting a variety of native trees, providing effective erosion control during construction and allowing natural field and marsh vegetation to grow on highway verges.

Mitigation of the impacts on wildlife, although difficult, include restoration plantings designed for wildlife habitat and, in addition, the improvement of remaining habitats can increase the productivity of the areas. Special construction procedures can be included to allow continued wildlife passage.

*Source: The Future of the Automobile in Canada; Transport Canada, 1979

The impact on the recreation and open space areas stem directly from the physical displacement of land used for the right-of-way and the indirect effects imposed on the lands immediately adjacent to the facility by imposing restrictions on its type of use. Importantly, none of the existing active recreation uses would be encroached upon by the construction of the roadway.

The major effect of road construction is to limit the passive recreation use of the lands adjacent to the facility. However, the construction of the roadway offers a number of opportunities to improve the Valley for active recreation uses. A considerable amount has been allowed in the cost estimates for landscaping and maintenance of access to the Valley. The amount totals approximately $3.5M through the King's Forest Park area.

The impact on the scenic resources relates to superimposing a major facility over existing Mount Albion Road. It is not a new crossing, but rather an expansion of the existing crossing. Again, landscaping techniques can be successfully used to reduce the effect on the scenic resources.

In a comprehensive study such as this, the final decision is never based on an individual opinion. A great many factors, which are often conflicting, must be considered. The multi-disciplinary scope of the study, together with the participation of the public, has produced a sound recommendation on a route. It is sound because all feasible alternatives have been examined, and the various environmental, social and economic impacts have been considered.

In summary, the Study Team recommended Alternative 2 as it was believed it was the least disruptive to the community and provided the best opportunity to achieve the desirable objectives for growth and development in the Region. Opportunities exist to mitigate some of the undesirable effects of construction particularly in the Red Hill Creek Valley. Significant additional costs over and above normal construction have been included to assist in maintaining the social and environmental standards demanded by the public.

6. DESCRIPTION OF THE UNDERTAKING

As a result of the in-depth assessment of the viable alternatives, the Study Team recommended **Alternative 2** be selected for detailing in Phase 4. This alternative will be the least disruptive to the community while providing the best opportunity to achieve the desirable objectives for growth and development in the Region.

Under Alternative 2, a freeway extends from the Queen Elizabeth Way at a new interchange and remains within and follows the Red Hill Creek Valley to a point just north of Greenhill Avenue. At this point, the roadway ascends from the Valley following the general alignment of existing Mount Albion Road to connect with the east-west roadway in the vicinity of Mud Street and Pritchard Road. Throughout the north-south segment, access would be controlled through interchanges at Barton Street, Queenston Road, King Street, Greenhill Avenue, Mud Street and Dartnall Road. All other road and rail crossings would be grade separated.

In the east-west direction, an at-grade arterial roadway extends from the Mud Street interchange through to the existing Mohawk Road interchange at Highway 403. The east-west facility generally follows the 60 m vacant corridor positioned immediately south of existing Limeridge Road.

The Study Team further recommended that property be protected adjacent to the east-west alignment to allow eventual upgrading of the east-west arterial roadway to a future freeway. In this way, the disruption to adjacent development could be minimized as a result of additional roadway construction when additional roadway capacity is needed.

6.1 DESCRIPTION OF THE FUNCTIONAL PLAN

This section of the report describes the details of the recommended plan for the proposed roadway facility. The plan was selected after examination of several alignments and interchange configurations. The sheet layout for the

recommended plan and profile is given in Figure 27. The detailed plans and profiles are shown in Figures 28 to 50. The following discussion supplements the detail provided in the exhibits and summarizes the factors considered in developing and finalizing the functional plan.

6.1.1 Design Criteria

The Roads and Transportation Association of Canada (RTAC) design standards were used for the project. Allowances were made in the grading to ensure that the initial four lane urban arterial could be expanded to a four lane urban freeway should it be warranted in the future. Consequently, the main line horizontal and vertical alignment conforms to urban freeway standards with a design speed of 100 km/h. Table 6.1 lists the design criteria urban freeways with a design speed of 100 km/h.

6.1.2 Cross Sections

A four lane urban cross section is proposed for the initial stage of the Mountain East-West Arterial. The section consists of two 3.75 m lanes in each direction with a 6 m raised median which allows for left-turn bays with lanes of 3.5 m at all major cross street intersections. Earth berms to screen and attenuate traffic noise would be constructed, where required, to a minimum height of 3.7 m. An allowance of 7 m from the edge of pavement to toe of slope at the berm has been made to facilitate the expansion to an urban freeway section in the future. This means that once the grading has been completed for berms and side slopes, it would not have to be disturbed again. The proposed back slopes on berms and cut sections are 2.5:1 to assist in confining the roadway excavation within the 61 m right-of-way. Grading for the berms would be accommodated, where necessary, within the 15 m easements on either side of the right-of-way.

Table 6.1

SELECTED DESIGN CRITERIA

North-South Parkway					
Classification				-	Divided Urban Freeway
Design Speed				-	100 km/h
Superelevation (e max)				-	0.06 m/m
Horizontal Curve				-	420 min.
Lane Width				-	3.75
Grade	-	Min.		-	0.30%
	-	Max.		-	5.0%
Vertical Curve	-	Sag -	Min. K	-	50
	-	Crest-	Min. K	-	70
			Des. K	-	110
Side Slopes -		Cut		-	3:1
	-	Fill		-	3:1 in Heights of Fill 1.2 m or less 2:1 in Heights of Fill Over 1.2 m
Back Slopes -		Cut		-	2:1 max (3:1 at Berm)

The ultimate cross section proposed for the North-South Parkway is a basic six lane urban freeway. The section consists of three 3.75 m lanes in each direction with a 7 m median which contains a 3 m shoulder on each side of a New Jersey type concrete barrier. Noise attenuation berms would not be required in the Valley but would be constructed at other locations where required. The proposed side slopes are 3:1 in heights of fill 1.2 m or less and 2:1 over 1.2 m to assist in keeping the amount of property required to a minimum. Back slopes are 2:1 maximum.

Figure 51 illustrates the typical ultimate roadway cross sections for the Mountain East-West Arterial and Figure 52 provides the typical ultimate cross sections assumed for the North-South Parkway.

6.1.3 Right-of-Way

Mountain East-West Arterial

Right-of-way for the east-west corridor has been acquired by the City of Hamilton and the Region as it has become available over the past several years. Although property has yet to be acquired throughout its length, a 61 m strip with additional property at interchange areas has been protected from the west limits of the City of Hamilton to east of Upper Ottawa Street. Easements 15 m wide along either side of the right-of-way allow for the construction of noise attenuation berms.

North-South Parkway

A basic 90 m right-of-way will be required in the north-south corridor. Additional property will be required at all interchange locations and areas of large cuts and fills. North of Mud Street, the Parkway is located almost entirely on property owned by the City or the Region and very little would be required from the private owner.

6.1.4 Traffic

The projected traffic volumes along the facility were refined to account for revisions in the computer modelling process and the adjustments to the proposed facility. The traffic volumes are illustrated in Figure 53. The lane requirements for the roadway facility were based on capacity operation given the Designated Development Capability traffic assignment.

The results of the analysis indicate that a basic four lane, limited access, east-west arterial, with intersections at-grade with the major north-south arterials, will be sufficient to accommodate the projected volumes between Glancaster Road and Upper Gage Avenue. At the west limits, the section between Glancaster Road and Highway 403 will require complete control of access in order to accommodate the planned Allarco development at a population of 18,800 residents.

East of Upper Gage Avenue, a six lane, at-grade arterial is required to provide a smooth transition section between the Mountain East-West Arterial and the North-South Parkway sections.

In the north-south segment of the facility, a basic six lane freeway facility will be required to accommodate the projected volumes from Dartnall Road through to Barton Street. North of Barton Street to the Queen Elizabeth Way, a four lane freeway section is proposed.

Signal synchronization of the proposed Mountain East-West Arterial was examined(28) to determine if intersection spacing was such that signal phasing could be established to ensure the steady progression of traffic through the system at a constant speed. The efficient flow of traffic through a series of signals is a significant requirement in the efficient operation of arterial roads.

A computer program was utilized to determine the potential through band available for traffic along the proposed route. With this aid, it was possible to determine the volume of traffic which can travel through the system at a constant speed unimpeded assuming ideal conditions, and to determine the

cycle length for the signals which provided the desired operating speed or vice versa. Furthermore, it was possible to determine offsets and cycle length which best accommodate priority green signals without affecting through traffic.

For this application, signal timing for each intersection was determined form the projected turning volumes and expected geometry. Likewise, the preliminary design was referenced to determine the distance between signals. A headway between vehicles of 2.1 seconds was assumed, and a range of speeds between 40 and 98 km/h was tested. The assumption of 90 second cycles was made for analysis purposes.

At a constant speed of 66 km/h, a platoon of vehicles would have a band width of 38.6 seconds for all signals assuming that the back-up of vehicles at the signal does not impede traffic. A total of 720 vehicles/lane can travel within this through band. The ability to provide for traffic progression at an attractive operating speed for the projected volumes was therefore confirmed. This would not be possible without introducing a grade separation at West Fifth Street.

6.1.5 Transit

The major focus for transit in accordance with the Region's Official Plan has been on the Central Business District where transit can be most successful in providing an attractive alternative to auto use. The diversion of a significant amount of auto traffic from the adjacent arterial system will result in an overall improvement in surface transit operating speeds along these arterials. As the proposed roadway facility is accommodating auto travel between the Mountain residential developments to the non-CBD employment opportunities north of the Escarpment, transit travel demand is projected to be low along the proposed roadway alignment. As such, no transit priority treatments such as exclusive bus lane operations have been incorporated into the roadway plan.

The proposed roadway construction impacts the Barton Trolley, the Parkdale and Saltfleet Community transit routes. In general, the modifications required to the transit routings are relatively minor and will not significantly affect public transit accessibility into the residential developments.

Specific revisions are summarized below:

Barton Trolley:

Eastbound vehicles presently routed along Melvin Avenue east of Talbot Street will be re-routed north to Barton Street. This re-routing will require construction of overhead wire for a distance of 1,000 feet along Barton Street and 500 feet along Melvin Avenue for westbound trolleys.

As the increase in distance of travel is minimal, no effect on schedules is anticipated.

Parkdale:

The present routing into the Vincent/Red Hill Community will be affected due to the closure of Mount Albion Road at King Street. Feasible options are available to provide a comparable level of service to this area by using the proposed extension of Pottruff Road to Hixon Road or the section of the proposed roadway between King Street and Greenhill Avenue.

Saltfleet Community:	Modifications to the present routing can be provided by Agate Street in lieu of Mud Street.

Future expansion of the transit services is generally not affected. The continuity of the major roadways is retained. A planned cross Mountain route along Limeridge Road will not be possible due to the discontinuities in Limeridge Road resulting from the construction of the Mountain East-West Arterial. Stone Church Road offers a viable alternative in providing this cross Mountain route.

6.1.6 Alignment

East-West Arterial

The horizontal alignment between Upper Horning Road and Upper Ottawa Street is basically that established by the City of Hamilton in past studies. The alignment west of Upper Horning Road is curvilinear with curves of 600 m radii. The alignment was connected to the existing Mohawk Road as quickly as possible west of Upper Horning Road to take advantge of the existing road allowance on Mohawk Road and to attain as much weaving distance between the ramps at Highway 403 and Glancaster Road interchanges as possible.

North-South Parkway

The horizontal alignment for the North-South Parkway is mainly curvilinear which was dictated by the numerous controls encountered. The alignment between Dartnall Road and Mud Street is a continuous 700 m radius curve. It was located as far as possible to the south to minimize the impact on the Albion Falls conservation area to the north without disrupting the recently constructed bowling alley situated on the north side of Stone Church Road. It also avoids the Hydro towers east of Pritchard Road.

North of Mud Street to the Park Access Road at Mount Albion Road, the alignment has been split on either side of the Hydro tower line creating a 50 m wide median. This was done so that the grades could be varied between the two independent northbound and southbound roadways as much as possible to fit the existing topography and reduce the property requirements on the east side of the Parkway.

The northbound lanes follow the existing Mount Albion Road alignment across the Escarpment on the east side of the Hydro tower lines with 1000 m and 450 m radii curves. This avoids acquiring property from the golf course situated along the east side of Mount Albion Road. The southbound lanes cross the Escarpment on the west side of the Hydro tower line with 600 m and 450 m radii curves. Access to the tower line is provided from the Park Access Road in the Parkway median. The alignment north of the Park Access Road at Mount Albion Road follows the top of the Valley to Greenhill Avenue on a tangent section with a 2000 m radius curve being introduced at Greenhill Avenue. It then proceeds through the Valley to the Canadian National Railway line, at which point the Valley becomes quite restricted in width. The controlling radius in this section is 450 m which appears in a number of locations throughout the Valley. The alignment then follows the Creek north and interchanges with the Queen Elizabeth Way. Every attempt has been made to keep the roadway within publicly owned property through the Red Hill Creek Valley.

The location of the Parkway alignment at the cross streets is fixed because of the interchange configurations and availability of right-of-way at their locations. An attempt has been made to keep the alignment, between interchanges, to one side of the Valley to retain as much parkland and recreation area as possible. The Creek has been rechannelled in several areas to minimize the number of crossings.

6.1.7 Profile

East-West Arterial

The vertical alignment through the east-west corridor has been established to freeway standards although the initial construction planned is for an urban arterial roadway with at-grade intersections with the major cross streets.

The grades have been established to create a balance, where possible, between excavation for the arterial roadway and fill for the noise attenuation berms. The roadway will be fully depressed either by excavating or by the creation of berms so that the minimum height between the top of pavement and the top of the excavation or berm is 3.7 m. The amount of cross street reconstruction was kept to a minimum by reducing the amount of excavation through the intersection and yet maintaining freeway standards.

The profile at the west end of the project meets the existing grade of Mohawk Road immediately east of the Highway 403 interchange. Although the terrain is relatively flat throughout the east-west corridor, vertical curves were introduced where necessary to achieve the desired results. The minimum sag curves has a K value of 70 and the minimum crest curve has a K value of 80. The grades throughout the east-west corridor vary between a minimum of 0.30 percent and a maximum of 2.0 percent. Preliminary estimates of earth quantities indicate that there is surplus material to be disposed of.

North-South Parkway

The vertical alignment in the north-south corridor conforms with the rolling terrain from Upper Ottawa Street to north of Greenhill Avenue. After descending into the Red Hill Creek Valley, it becomes very flat until it reaches Brampton Street.

The alignment east of Upper Ottawa Street is controlled by the clearance below the CNR in maintaining the existing railway grade, and the Red Hill Creek in the vicinity of Dartnall Road. The profile was raised slightly to minimize the amount of excavation through the area. The major concern is the large rock excavation and fill where the alignment crosses the Escarpment north of Mud Street. The initial soils investigation in this area pointed out the concern of such an undertaking but that no special construction technique need be employed. A more detailed investigation was carried out confirming the initial results that conventional construction methods could be employed.

The proposed grade across the Escarpment is 5.0 percent which is the maximum for the project. The minimum grade, which occurs in the Valley, has been established at 0.40 percent. In maintaining the existing CNR grade across the Valley, the proposed freeway alignment is dictated by the clearance required below the railway. The proposed grade for the remainder of the Valley has been established at an average of 2 to 3 m above the Valley floor to minimize the impact on drainage and the possibility of flooding. A minimum sag curve with a K value of 50, and crest curve with a K value of 120 have been established for the north-south corridor.

6.1.8 Intersections, Interchanges and Grade Separations

East-West Arterial

Major arterial streets crossing the east-west corridor will intersect the proposed roadway at grade. The only exceptions are the Mohawk Road/Golf Links Road connection and West Fifth Street which will be grade-separated with no access to the proposed roadway. The Mohawk Road/Golf Links Road connection will not intersect the east-west roadway because of its proximity to the Highway 403 interchange. West Fifth Street will be grade-separated to provide uniform spacing between the remaining signalized intersections.

At-grade intersections with left-turn bays will be provided with the following streets:

- Glancaster Road
- Upper Paradise Road
- Garth Street
- Upper James Street
- Upper Wellington Street
- Upper Wentworth Street
- Upper Sherman Avenue
- Upper Gage Avenue
- Upper Ottawa Street

North-South Parkway

Interchange locations and types were developed based on projected traffic movements and the ability to adapt to the restrictions imposed upon them by the Red Hill Creek Valley and adjacent property.

Interchanges are planned for the following locations:

- Dartnall Road
- Mud Street/Trinity Church Road
- Greenhill Avenue
- King Street
- Queenston Road
- Barton Street

Grade separations with no access to the facility are planned with the following streets:

- Pritchard Road
- Agate Street
- Mount Albion Road Park Access
- Brampton Street

Interchange spacings between Greenhill Avenue and the Queen Elizabeth Way are at a minimum. Although weaving lengths are adequate, ramp terminals are located close enough together so that continuous acceleration and deceleration lanes are provided between the interchanges in most cases.

Dartnall Road Interchange

The interchange proposed for this location is a Trumpet with a 40 m loop. Its primary function is to provide access to the industrial land immediately to the south. A 40 m loop has been adopted to minimize the property requirements in the vicinity of the conservation area to the north. A number of configurations were reviewed based on Trumpet and Diamond configurations. The Trumpet type was preferred because:

- it is the most efficient configuration to accommodate traffic volumes and offers considerable flexibility in responding to volume fluctations;
- the land requirements are not significantly different. In order to minimize the land consumption, a 40 m loop ramp was adopted to accommodate the N/W traffic movement. While the design speed is reduced, it will be consistent with the operating speed along Dartnall Road;
- the construction cost is less due to minimizing the length of the CNR grade separation; and
- there is an increase in the weaving length between the interchange and the at-grade intersection at Dartnall Road and Stone Church Road. This provides improved freeway operation through this section.

Mud Street/Trinity Church Road Interchange

The interchange proposed for this location provides access to the Salfleet Community in the east by Mud Street, and access from the industrial area in the south and connection to Highway 53 by Trinity Church Road. Although the freeway interchanges with two arterials, the connections to these streets are relatively direct and free flowing.

Greenhill Avenue

The Greenhill Avenue interchange is a Trumpet. A 40 m loop has been used to keep the interchange ramps from protruding into the Valley. It will provide access to and from the Vincent/Red Hill neighbourhoods.

Three optional interchange configurations were assessed including:

- a conventional Diamond configuration
- a "point" Diamond configuration
- a Trumpet configuration

Based on the evaluation, a Trumpet interchange is recommended for the following reasons:

- the land requirements are similar in all configurations studied. The differences are not significant in that all can be contained within the plateau area without encroachment on the Valley slope or the abutting residential and institutional properties;

- the Trumpet interchange provides for free flow traffic movements while the Diamond type would require at-grade signalized intersections at the ramp terminals. As a result, the capacity provided is greater, although perhaps not critical at this location because of the projected traffic volumes;

- the cost of construction of the Trumpet interchange is comparable to the conventional Diamond although less than the "point" Diamond arrangements studied; and

- the provision of a low speed loop ramp proposed is not considered a disadvantage because of the projected low volume of traffic and the approach from an arterial with a relatively low operating speed.

King Street/Queenston Road/Barton Street

Due to the close proximity of these interchanges, this area was treated as a single complex. Eight different configurations were reviewed and are illustrated in the attached sketches. The initial scheme outlined in Phase 3, which extended Lawrence Road across the Valley to connect with Mount Albion Road was rejected since this extension would be very costly compared to other schemes, would not provide a suitable connection between the Parkway and Lawrence Road and would create extensive property disruption in the vicinity of Hixon Road.

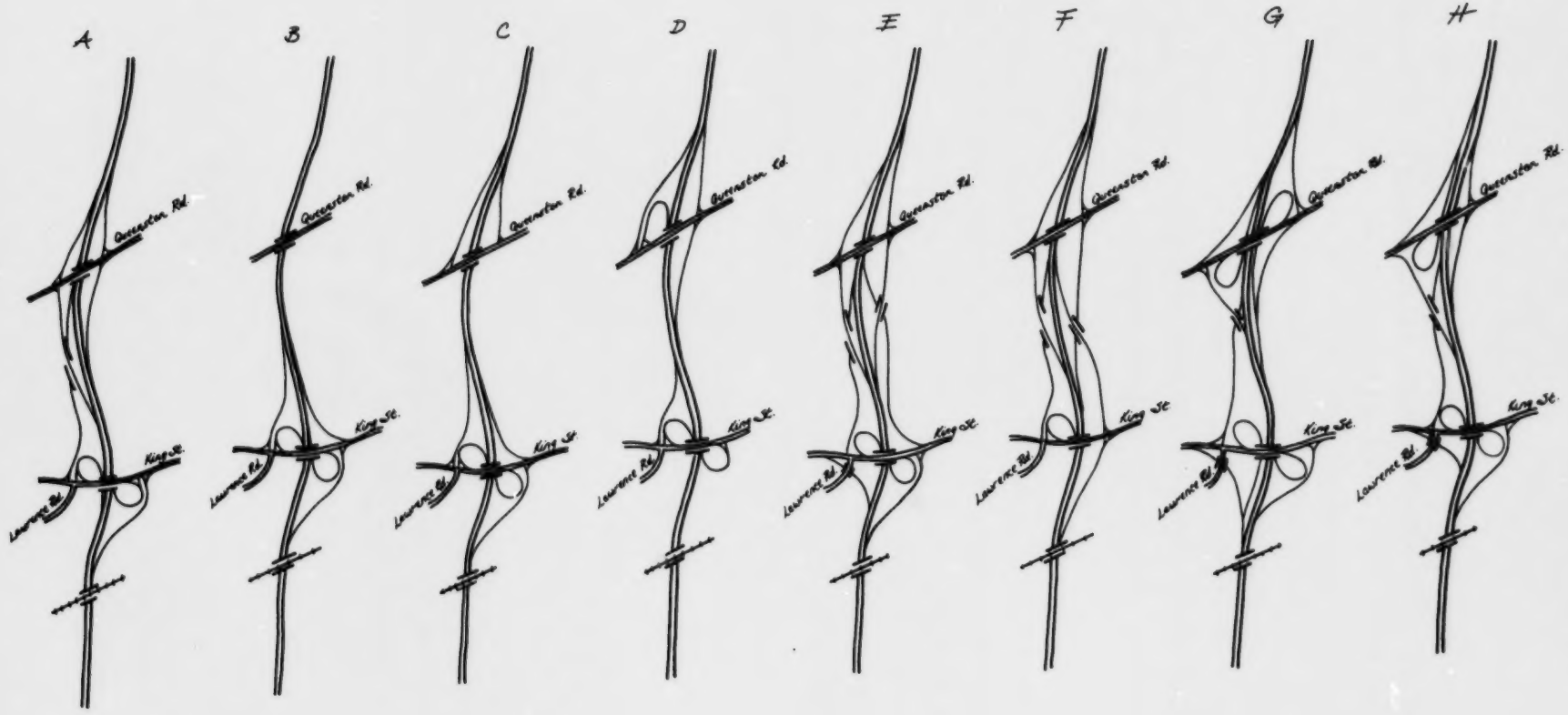
In brief, Schemes E and F were rejected because of the magnitude of the land dedication required in the narrow portion of the Valley. The additional construction cost and land acquisition is not justified by the projected traffic volumes accommodated by the additional separate interchange ramps.

Scheme D was not considered suitable due to:

- the feasibility of the loop in the northwest quadrant being uncertain because of property restrictions; and
- the weaving length provided for southbound traffic between the two interchanges being insufficient.

Schemes B and C were rejected because of the removal of specific traffic movements at Queenston Road. Greater traffic loads would be placed on King Street and Barton Street interchanges. Ramps S-E and E-S at these two locations would be operating under forced flow conditions in the peak periods.

As a result, the analysis focused on an evaluation of Scheme A, Scheme G and Scheme H. Based on the detailed assessment, Scheme H was adopted. Trade-offs between property disruption, freeway operation and arterial capacity were considered in making the selection. It was felt that Scheme H represented a reasonable balance of the trade-offs amongst the short-listed options.



MOUNTAIN EAST - WEST and NORTH - SOUTH
CORRIDOR STUDY

KING STREET / QUEENSTON ROAD INTERCHANGE ALTERNATIVES

DeLCan

The Parclo "A" type of interchange at King Street accommodates all traffic movements, with the exception of ramps from King Street, east to north and the return from the north to King Street East. Because of the weaving problems that would be created with the closeness of the Queenston Road interchange, these movements have been eliminated and the ramp from the north to King Street is grade-separated with the ramp from Queenston Road to the south. Lawrence Road is also accomodated in the interchange configuration and is aligned with the ramp complex on the west side of the freeway resulting in a single at-grade intersection. Fifty metre radius loops are utilized.

At Queenston Road, a combination Diamond/Parclo "B" interchange has been provided at this location to handle all the traffic movements, minimize the physical impact on the surrounding area and optimize the capacity of Queenston Road through the interchange area. A Parclo "A" type of interchange is proposed at Barton Street to accommodate the projected traffic movements. This interchange configuration fits well within the available vacant land and optimizes traffic operation.

6.1.9 Drainage

East-West Arterial

A storm sewer system will be provided to handle the stormwater drainage in the east-west corridor. Side slopes for berms and cut areas will drain into roadside swales. The storm sewer size and location of outlets will be determined in the final design stage.

North-South Parkway

A rural freeway cross section is proposed for the north-south corridor, and the storm drainage will be carried through a system of ditches and culverts. The

median will be drained by catchbasins with leads to the ditches. Drop structures will be incorporated in the major realignments to reduce the flow velocities.

The drainage study conducted in Phase 4 addressed the following issues:

- impact of road construction on the flooding capacity of the Valley;
- confirmation that the currently established floodline elevations did not account for the retention effects of the existing culverts at the T.H. & B. Railway, Queenston Road and the CNR. Nor did this investigation take into account stormwater management techniques currently under investigation by the City of Hamilton;
- assess the feasibility of the proposed rechannelization of the Red Hill Creek indicated under the recommended plan.

The proposed design ensures the culverts will be of sufficient size so as not to interfere with the flood flows. In addition, the improvements to the existing culverts will reduce the high backwater situation due to the existing undersized culverts at the T.H. & B. Railway crossing, Queenston Road and the CNR crossing. Due to the proximity of the site to the mouth of the watercourse, enlarging the existing culverts will not cause any flooding downstream. A proper ratio of backwater reduction to interference with flood flows by the construction of the proposed roadway will result in a negligible effect on flood levels.

While the Ministry of Natural Resources requests that any proposed bridge or culvert crossing be analyzed using the Regional storm criteria, this does not mean that the structures must be capable of passing Regional flows. The intent is to ensure no significant backwater effect is created.

The establishment of the floodline elevations in the M.M. Dillon report was based on unrestricted flows in each section of the watercourse. This was done to protect against the possibility of existing structures being removed and/or replaced by larger structures to permit Regional flows along each section.

No effects of the possible application of stormwater techniques were accounted for. Introduction of these techniques could potentially reduce the stormwater flows and lower the current projected Regional floodline elevations within the Valley.

The suggested rechannelization of the Red Hill Creek will create minimal disturbance to the Valley walls and the number of culverts has been kept to a minimum. Channelization of part of the watercourse will be considered by the Ministry of Natural Resources since there is no concern with regard to impact on fish populations. The fact that the site is close to the mouth of the watercourse alleviates concern related to increased flows due to channelization. The Valley is well defined in this area.

6.1.10 Railway Considerations

There are three railway crossings in the North-South Parkway portion of the project:

- CNR between Barton Street and Brampton Street at mile 38.6 on the Grimsby Subdivision
- CNR in the vicinity of Dartnall Road at mile 6.1 on the Hagersville Subdivision
- T.H. & B. south of King Street

The CNR has two tracks at present on the Grimsby Subdivision with future planning for two additional tracks. The line presently carried 20 trains per day. The CNR line on the Hagersville Subdivision has one track at present with future planning for one additional track. It presently carries 8 trains per day. The T.H. & B. has one track at present with no plans for expansion in the future. The present daily train movements are 8 to 10 trains per day.

Special consideration was given to a preliminary investigation of a method of construction at the CNR Grimsby Subdivision crossing and the T.H. & B. crossing. Because of the difficulty in rerouting rail traffic in these locations,

it was suggested that methods permitting rail useage during construction may provide an attractive alternative. This may require specially designed ground support systems, some cut and cover, and tunnelling type operations, coupled with some type of localized rail diversions.

Boreholes were put down at the two embankments to permit a more detailed analysis of the subsoil conditions. The analysis confirmed conventional construction techniques were feasible in both these locations. The proposed structures would be constructed in accordance with the railway requirements and ensure that the existing railway grades and alignment would be maintained. The CNR and T.H. & B. Railway were contacted and the proposals discussed.

6.1.11 Geotechnical

Mountain East-West Arterial

The investigations[29] confirmed the feasibility of construction from a geotechnical point of view. In the east-west corridor, the soils problems cited were local in nature and are not expected to present major difficulties.

North-South Parkway

To supplement the data compiled from previous studies, eleven additional borings were advanced at those locations where some particular geotechnical problems could be anticipated. Two borings were also advanced at the T.H. & B. and CNR crossings to investigate the nature of the embankment fill at each location. It was found that, at specific points along the route, virtually every type of soil which is characteristic to the Hamilton area is represented with subsequent significantly varying results on road design and construction. Major problems associated with the geotechnical conditions are not anticipated although special consideration should be given to design and the

construction techniques employed in areas of rock excavation and the railway grade separations crossing the Valley.

Subsequent to the submission of the Phase 4 geotechnical report[30], additional borings were requested by the Ministry of Transportation and Communications in the vicinity of the Escarpment crossing. The investigation confirmed the feasibility of constructing a roadway in the proposed location is possible without encountering major difficulties. The alignment represented an ideal location for a roadway crossing of the Niagara Escarpment in the Mount Albion Road area.

6.1.12 Utilities

Mountain East-West Arterial

Existing utilities were located on a preliminary basis from information made available by the Region and the various utility companies. Underground utilities crossing the east-west corridor have been placed at a sufficient depth and the proposed grade of the arterial has been established to avoid conflicts. Overhead utilities on major streets crossing the corridor would have to be relocated for widenings and grade separations.

North-South Parkway

Major utilities in the Red Hill Creek Valley do not present clearance problems since the proposed Parkway grade is 2 to 3 m above the Valley floor. Bell Telephone, Hydro, gas and watermains located on the streets crossing the Valley would have to be relocated.

The storm and sanitary sewers on Pritchard Road would have to be replaced because of the excavation required for the Parkway construction. Hydro towers between Stone Church Road and Greenhill Avenue have been avoided.

A possible conflict could occur with the Trans-Northern Pipe Line where it crosses the Escarpment along Mount Albion Road north of Mud Street. This will be subject to further investigation in the detailed design phase.

6.1.13 Staging and Implementation

The staging program reflects the priority of construction for major route segements, a logical construction sequence and recognition of the financial capabilities of the Region.

The major priorities for the road construction are based on the development objectives of the Region and the projected location of the deficiencies in the road network as growth and expansion take place. These factors and issues are listed below:

- provision of expanded roadway facilities to improve accessibility between the Mountain residential areas and the employment opportunities north of the Escarpment. The improved accessibility will allow continued growth of the Saltfleet Community, the planned residential areas south of Limeridge Road and the Mountain Industrial Park;

- removal of through traffic and truck traffic from the adjacent parallel arterials with abutting residential development;

- minimize the magnitude and duration of construction disruption on the adjacent neighbourhoods;

- initial staging of construction should not represent the ultimate facility in order to be compatible with a possible dramatic shift to public transit. As a result, the initial facility was sized based on the 2001 traffic forecast; and

- tailor construction costs to an approximate annual expenditure of $12M (1982).

Based on the above, the staging focused on the provision of a new roadway facility between the arterial roadway network above the Escarpment to the arterial system below the Escarpment. The initial completed roadway would provide a basic four lane facility. It would satisfy the basic objectives as:

- it would provide expanded roadway capacity to accommodate the expansion of the Saltfleet Community and the development of the Mountain Industrial Park;
- it would remove through traffic from Mount Albion Road and reduce truck traffic along the Kenilworth Access and Centennial Parkway; and
- the proposed construction can be accomplished with little disruption of local circulation patterns.

The staging of construction is illustrated in Figure 54, and discussed in the remainder of this section of the report.

Stage 1 - Upper Gage Avenue to King Street

A four lane rural freeway section would be constructed from Upper Gage Avenue to King Street. The construction would include the following structures and interchanges:

- CNR grade separation immediately west of Dartnall Road
- Pritchard Road grade separation
- Mud Street - Trinity Church Road interchange
- Agate Street grade separation
- Mount Albion Road underpass structure
- Greenhill Avenue interchange
- T.H. & B. Railway grade separation
- King Street realignment and interchange construction

- Extension of Lawrence Road
- Extension of Pottruff Road to Hixon Road

As part of this stage of implementation, various local road improvements would be included:

- the realignment of Mud Street from Paramount Drive East to Paramount Drive West
- the extension of Trinity Church Road from Rymal Road to Stone Church Road
- the extension of Agate Street from Paramount Drive to Mountain Brow Boulevard

The above construction is not reflected in the construction costs given for the proposed facility.

The implementation of this stage of the proposed facility would be phased. To minimize the disturbance of traffic flow crossing the Escarpment, the southbound lanes would be constructed first and operated in both directions. This essentially replaces existing Mount Albion Road. Once this is completed and opened to traffic, Mount Albion Road would be closed to allow construction of the northbound lanes. In this way, the traffic disruption can be kept to a minimum during construction.

Stage 2 - King Street to Queen Elizabeth Way

A four lane rural freeway section would be constructed from King Street to the Queen Elizabeth Way. The construction would include the following structures and interchanges:

- completion of the King Street interchange ramps
- Queenston Road interchange
- Barton Street interchange
- CNR grade separation
- Brampton Street grade separation

- Queen Elizabeth Way interchange

The construction cost estimates included under this project extend to the north property limits of Brampton Street. The roadway and interchange construction north of Brampton Street is the responsibility of the Ministry of Transportation and Communications.

Similar to Stage 1, the construction in Stage 2 would be phased. With the roadway access across the Red Hill Creek Valley being limited to three crossings at King Street, Queenston Road and Barton Street, the construction phasing must be carried out to minimize serious traffic disruption.

Accordingly, it is recommended that the Brampton Street Extension be completed prior to construction beginning at either Queenston Road or Barton Street. Secondly, it is recommended Barton Street be completed prior to Queenston Road. This is suggested since the Barton Street construction can be carried out without major traffic disruption by utilizing the present Melvin Avenue crossing together with the Brampton Street Extension. Once the Brampton and Barton Street crossings are in place, the disruption of traffic due to the partial closing of Queenston Road can be minimized.

Stage 3 - Upper Gage Avenue to Highway 403

A four lane urban arterial would be constructed between Upper Gage Avenue and Highway 403. Again, the construction will be phased in keeping with the financial capability of the funding agencies. The completed segments would be terminated at the major north-south arterials. With construction contained within the protected right-of-way, disruption of existing traffic patterns would be minimized.

Subsequent Stages of Construction

As growth occurs and traffic volumes increase, the ultimate development of the facility would be carried out. The estimated cost of the remaining construction to expand the initial facility totals $7,795,000 and includes the following:

- widening of the controlled access section east of Upper Ottawa Street to Barton Street to provide a six lane urban freeway facility;
- widening of the four lane urban arterial section from Upper Ottawa to Upper Gage Avenue
- construction of the Dartnall Avenue interchange

Beyond these specific construction projects, sufficient right-of-way has been reserved to construct interchanges at:

- Upper Gage Avenue;
- Upper Wentworth Street;
- Upper James Street;
- Garth Street; and
- the Glancaster Road Extension.

The cost estimates for the individual stages are summarized in the next section based on 1982 unit prices for similar construction. These estimates are general and should be used to provide an indication of the scope of the work included in each individual stage. The phasing likely within each stage and the extended time frame for the actual construction renders the use of current unit prices non-representative.

6.1.14 Cost Estimates

A cost estimate was prepared for the project as a whole and then broken down into stages based on a logical sequence of construction and the Region's financial capabilities.

The estimate was based on 1982 unit prices obtained from recent construction projects and the major items are listed below:

Railway Structures		$ 1,560.00/m2
Road Structures		
sta 10+700 to sta 22+750		
	Single Span	$ 780.00/m2
	Multi Span	$ 720.00/m2
sta 22+750 to sta 29+175		
	Single Span	$ 900.00/m2
	Multi Span	$ 840.00/m2
Earthworks		$ 4.50/m3
Rock Excavation		$ 8.00/m3
Hot Mix	- HL1	$ 20.00/t
	- HL5	$ 19.00/t
	- HL2	$ 19.00/t
	- Asphalt Cement	$ 225.00/t
Granular "A"		$ 6.20/t
Granular "B"		$ 5.00/t

The estimate of the property required for the project was updated and included in the total cost.

Table 6.2

TOTAL PROJECT COST ESTIMATE - 1982 BASIS

Roadwork	
• earth excavation	$ 16,415,000
• rock excavation	3,320,000
• granular material	11,030,000
• paving	10,550,000
• curb and gutter	1,765,000
• illumination	3,095,000
• utility relocation	2,060,000
• drainage	1,510,000
• landscaping	3,090,000
• noise attenuation	700,000
• median barrier	430,000
• traffic signals	435,000
• fencing	895,000
Structures	
• railway structures	2,800,000
• roadway structures	21,280,000
• creek structures	7,785,000
• retaining walls	310,000
• railway detour structures	4,200,000
Engineering and Contingencies	14,765,000
Property	16,880,000
Restoration of Recreation Facilities	600,000
Total	$123,915,000

Table 6.3

STAGE 1 COST ESTIMATE - 1982 BASIS

UPPER GAGE AVENUE TO KING STREET

Roadwork	
• earth excavation	$ 8,730,000
• rock excavation	3,320,000
• granular material	5,410,000
• paving	4,150,000
• curb and gutter	660,000
• illumination	1,355,000
• utility relocation	910,000
• drainage	660,000
• landscaping	1,350,000
• noise attenuation	300,000
• median barrier	-
• traffic signals	95,000
• fencing	375,000
Structures	
• railway structures	1,540,000
• roadway structures	10,585,000
• creek structures	3,650,000
• retaining walls	240,000
• railway detour structures	2,400,000
Engineering and Contingencies	7,340,000
Property	5,870,000
Restoration of Recreation Facilities	600,000
Total	$ 59,540,000

Table 6.4

STAGE 2 COST ESTIMATE - 1982 BASIS

KING STREET TO QUEEN ELIZABETH WAY

Roadwork	
• earth excavation	$ 2,345,000
• rock excavation	-
• granular material	2,540,000
• paving	1,675,000
• curb and gutter	260,000
• illumination	600,000
• utility relocation	400,000
• drainage	290,000
• landscaping	600,000
• noise attenuation	400,000
• median barrier	-
• traffic signals	50,000
• fencing	145,000
Structures	
• railway structures	1,260,000
• roadway structures	8,260,000
• creek structures	4,135,000
• retaining walls	70,000
• railway detour structures	1,800,000
Engineering and Contingencies	3,990,000
Property	2,250,000
Restoration of Recreation Facilities	-
Total	$ 31,070,000

Table 6.5

STAGE 3 COST ESTIMATE - 1982 BASIS

UPPER GAGE AVENUE TO HIGHWAY 403

Roadwork	
• earth excavation	$ 5,100,000
• rock excavation	-
• granular material	2,660,000
• paving	3,020,000
• curb and gutter	690,000
• illumination	820,000
• utility relocation	550,000
• drainage	400,000
• landscaping	820,000
• noise attenuation	-
• median barrier	-
• traffic signals	290,000
• fencing	375,000
Structures	
• railway structures	-
• roadway structures	1,440,000
• creek structures	-
• retaining walls	-
• railway detour structures	-
Engineering and Contingencies	2,425,000
Property	7,020,000
Restoration of Recreation Facilities	-
Total	$ 25,610,000

6.2 CONSTRUCTION IMPACTS AND MITIGATING MEASURES

During the impact assessment analysis and the public review, several issues and concerns were expressed regarding the future implementation of this preferred facility. It was recognized opportunities existed to reinforce the positive benefits of implementation and to mitigate against some of the undesirable effects of construction. The remainder of this section of the report highlights the findings of the additional investigations carried out to specifically address these issues. Particular areas where the preliminary plan developed in Phase 3 has been modified are identified.

Phase 3 of the project highlighted the relative impacts of implementation of the viable alternatives on a corridor scale. The intent of the investigations carried out in Phase 4 focused on the impacts of construction on a local scale, and addressed the pertinent issues raised by the public.

The impact categories investigated include the following:

- community cohesion;
- accessibility of the facilities and services;
- displacement of people;
- effects on local business;
- residential activity;
- fiscal effects;
- regional and community plans;
- resources and energy;
- scenic resources, recreational resources and historic values;
- effects on natural environment;
- air quality; and
- noise pollution.

In the discussion of each category, the magnitude, incidence and significance of the effect is related to the No-Action alternative where possible. The data presented represents the results of the more detailed investigations carried out in Phase 4 and information assembled in previous phases of the project.

6.2.1 Community Cohesion

Community cohesion refers to the way in which residents perceive their area or neighbourhood. The effect of roadway construction may result in the displacement of people, the creation of a barrier effect between community residents or more subtle effects such as changes in the physical space or the form of the area. The impact may also be positive by creating a boundary which assists in more sharply defining an area or neighbourhood. No single method is available to confidently measure impacts on community cohesion. Therefore, the assessment relied on information generated by past and current land use planning, and public comment.

The magnitude of the impact of the selected facility construction on community cohesion is minimal. The selected location for the facility follows current established community boundaries. In the east-west direction, the roadway has been proposed within a designated and generally vacant corridor. The corridor was established in 1968 under OPA #228 and was incorporated as a principal planning feature of the road pattern and in the structuring of the neighbourhoods in this area. Since 1968, neighbourhood planning and development of these neighbourhoods has proceeded on the basis that a major roadway would be built along this protected corridor.

In comparison to the No-Action alternative, the construction of the east-west facility yields a positive impact by allowing the planned downgrading, and incorporation of existing Limeridge Road into the local street system. The community cohesion north of the protected right-of-way will be improved.

In the north-south segment of the facility, the roadway is contained primarily within public open space. The form of the adjacent residential areas is not altered. In comparison to the No-Action alternative, the impact is considered positive through the significant reduction of the through traffic volumes along Mount Albion Road, Upper Ottawa Street, Kenilworth Avenue, Parkdale Avenue, Woodward Avenue and Nash Road. The reduction of traffic volumes

along these roadways which provide direct access to abutting residential development will have a positive influence in improving the community cohesion of the abutting neighbourhoods.

6.2.2 Accessibility of Facilities and Services

Ease of access to and from facilities and services affects the quality of neighbourhood life. The impact is caused by changes in travel patterns and/or changes in the supply of community facilities and services.

Full access is provided to the proposed facility from all major roadways in the arterial grid system. The exceptions to the above include:

i) Mohawk Road - Golf Links Road

The intent of this configuration is to ensure the major east-west volumes of through and interurban traffic between residential, commercial and industrial zones is shifted from Mohawk Road to the proposed Mountain East-West Arterial. The reduction of traffic volumes along Mohawk Road will improve the living amenity for the adjacent residential development.

The disruption of local traffic patterns is minimal as access is provided to the north-south arterial grid system from all residential zones.

ii) West Fifth Street

The provision of an at-grade intersection between West Fifth Street and the proposed Mountain East-West Arterial would not allow desirable traffic signal progression along the facility. The grade separation was introduced to reduce traffic delay and vehicle operating costs in addition to minimizing the potential accident rate.

iii) Pritchard Road

Local access to the existing facilities and residential development in this area will not be significantly affected. A high level of access will be maintained through the substitution of the Trinity Church Road Extension and through adjacent interchanges at Dartnall Road and Mud Street.

The realignment of Mud Street is based on the development plan for the Saltfleet Community. As such, the proposed roadway alignment is compatible with the Saltfleet Community development.

iv) Mount Albion Road

Under the proposed plan, Mount Albion Road will be downgraded to a local street within the Red Hill neighbourhood. However, this will not adversely effect access to this area. Travel to the north and south of the area will be directly accommodated through the interchange provided at Greenhill Avenue. In addition, as further development takes place, access to King Street East will be further improved with the easterly extension of Greenhill Avenue.

Three other closures of existing roadways are also included under the proposal namely:

- Melvin Avenue at Neil Avenue
- Pottruff Road at Barton Street
- Arbour Road adjacent to the proposed facility

The current Melvin Avenue crossing of the Red Hill Creek Valley cannot be maintained due to the Barton Street interchange construction with the proposed north-south roadway. No reduction of accessibility will result from this closure.

The Pottruff Road connection to Barton Street cannot be maintained due to the construction of the Barton Street interchange with the proposed north-south roadway. The number of residents inconvenienced by this closure totals 14 households. The average increase in travel distance for these residents is approximately 0.70 km. Arbour Road is a local, rural type road with households having direct access. While the road closure will create greater travel distances, the increase will not be significant. Under the approved neighbourhood plan for this area, it is the intention of the City of Hamilton to eventually eliminate Arbour Road completely.

In general, the accessibility of the residential neighbourhoods adjacent to the facility will be significantly improved to the major existing employment area along Burlington Street, to the Limeridge Mall abutting the proposed facility at Upper Wentworth Street, to the Mountain Industrial Park under development in the vicinity of Dartnall Road, and to the industrial development along the Queen Elizabeth Way in Stoney Creek. The increased accessibility to the Saltfleet Community will improve its attractiveness for continued development to its ultimate potential.

Accessibility to local neighbourhood educational, religious, and recreational facilities will not be adversely affected due to the location of the roadway adjacent to established neighbourhood boundaries throughout its length.

Changes in local pedestrian and vehicular traffic patterns are minimal. The facility is located along existing barriers to movement, specifically established rights-of-way in the east-west direction and the Red Hill Creek Valley in the north-south direction. The provision of properly located pedestrian crossings of the Red Hill Creek Valley was a major objective of the Recreation Master Plan Development. The proposed plan ensures the protection of a portion of the present pedestrian routes and affords additional opportunities through the provision of pedestrian walkways throughout the length of the Red Hill Creek Valley. The roadway construction will limit pedestrian access within the Valley by virtue of the physical construction of the roadway.

Accessibility to public transit will not be altered. The required routing revisions are minor and it was confirmed that the same level of service can be maintained. Further, the planned expansion of the bus routes is not affected by the proposed roadway construction.

At a Regional scale, the proposed facility will upgrade the current level of accessibility under a planned growth to 550,000 population. The No-Action alternative is not adequate to maintain the present level of accessibility given the projected growth. The analysis suggests the current low level of accessibility within the urban area is a contributing factor to the slow development of the residential and industrial lands south of the Escarpment.

The efficient movement of goods and services is being affected by the current lack of attractive transportation routes. This results in a decline of the competitive advantage of the established and planned industrial and commercial developments within the Region.

6.2.3 Displacement of People

Displacement has three aspects related to the number of families displaced, the probability that equivalent housing can be found for those affected; and the psychological impact of the relocation process.

A detailed survey was carried out to compile data on the potential properties affected by right-of-way acquisition. A total of 66 residential properties are required. No business enterprise is affected by the proposed roadway construction.

The majority of the residential property acquisition is restricted to the designated east-west corridor. Four homes are required in the north-south corridor at the Queenston Road interchange. A breakdown of the total right-of-way acquisition is tabulated below:

Private Property	
• occupied	65.2 Ac. (66 homes)
• vacant	67.9 Ac.
Public Lands	
• City owned	245.5 Ac.
• Region owned	22.4 Ac.
• Hamilton Region Conservation Authority	19.7 Ac.
• Ontario Housing Corporation	84.7 Ac.
• Railways, Utilities	17.8 Ac.
• Board of Education	0.2 Ac.
Total	523.4 Ac.

Source: Regional Engineering Department 81-09-01

The probability of replacement housing being found is good. This conclusion is based on the magnitude of the families to be relocated in comparison with the number of existing and planned housing units within the immediate area. This will reduce the potential difficulty in obtaining equivalent housing.

In particular, a major concern of most of the affected property owners is the uncertainty surrounding the future of the facility. These anxieties have been felt for over 10 years as a result of the designation of the right-of-way for the proposed roadway approved under OPA #228. The property owners apparently are having difficulty in disposing of their property. Recently, to overcome this difficulty, the Region, with the consent of the Ministry of the Environment, has purchased property in demonstrated hardship cases.

An additional aspect is the time available for relocation. Under the proposed staging, construction of the roadway in the east-west corridor is not anticipated for approximately 5 to 10 years. As a result, the impact of relocation is significantly reduced as to the extended period provides considerable flexibility in the timing of actual relocation. Of the 66 homes to be acquired for the ultimate development of the east-west roadway, 37 houses

are not required until full control of access is provided through the construction of interchanges and grade separations.

6.2.4 Effects on Local Business

The economic impact of a transportation facility is measured by changes in employment, income and business activity. Measures of business activity include the number and types of firms, their employment, sales volumes, and earnings. Direct economic impact includes displacement as well as the generation of jobs and income through the purchase of goods and services needed to construct the transportation facility. Indirect economic effects include induced growth and the redistribution of economic activity because of shifts in transportation costs and accessibility to markets and resources. Transportation is one of several major factors in long-term economic growth.

The magnitude of direct economic impact in terms of the businesses and employment displaced is nil since no existing business is affected. Indirect economic effects, i.e., induced growth and redistribution of economic activity have been assessed subjectively in relation to specifically planned developments.

The East Mountain/Glanbrook Industrial Park

The East Mountain Industrial Park had been planned based on the provision of relatively easy access to a major new roadway facility. There is no question that the attractiveness of this Park would be greatly improved with the provision of expanded roadway facilities linking the Industrial Park with Highway 403 and Queen Elizabeth Way. It is understood that a number of firms have not located in this Park due to the poor accessibility and the availability of other serviced industrial sites in a wider area with direct access onto freeway facilities.

The Mountain Subregional Centre

The Limeridge Mall, a major retail/commercial centre of approximately 70 acres, at the northeast corner of Upper Wentworth and Limeridge Road opened in 1981. The market for the retail facilities to be included in the centre presently exists. However, the chances of success of the shopping centre and creation of a subregional centre will be greatly improved by the provision of a major roadway adjacent to the site.

No detrimental indirect effect on local business is forecast as a result of the roadway construction. This conclusion is based on the following:

- the accessibility from the residential neighbourhood to the collector/arterial street system is not altered. Present traffic circulation patterns are substantially maintained.

  The access to and exposure of Mohawk Nurseries located on Mohawk Road was felt to be affected adversely in the initial plans of the roadway system. The roadway pattern was refined in a satisfactory manner.

- the diversion of traffic from the adjacent arterial street system is not foreseen as having a major impact on local business operations. The composition of traffic is almost totally intra-urban and through traffic volumes represent less than 10 percent of the total. Consequently, the effect on highway commercial business is expected to be minimal.

In comparison with the No-Action alternative, the impact on employment, income and business activity is viewed as positive. Under the No-Action alternative, access will be reduced as congestion on the existing streets will increase transportation costs. This applies not only to potential new business development, but also to the viability and competitive advantage of present business.

6.2.5 Residential Activity

Impacts on residential activity involve project induced changes in the quality and quantity of housing in the Region or communities, as well as residential location patterns. These changes are a function of displacement due to right-of-way takings and changes in Regional accessibility patterns.

The impact of the proposed facility construction is considered positive due to the following:

- The planned facility location is compatible with the planned residential community development on the Mountain and the Salfleet Community. The leve of accessibility provided by the proposed facility is viewed as an essential planning tool in achieving the objectives of the Official Plan to develop this distribution of residential development.

- The recent residential development adjacent to the right-of-way in the east-west corridor has been planned under strict guidelines to achieve an acceptable living environment adjacent to the facility. Regulations have been instituted regarding noise attenuation and visual intrusion protection through the provision of an easement to allow the construction of earth berms along the right-of-way and specific techniques in the design of the dwelling unit such as double glazing of windows and air conditioning.

- The location of the north-south roadway in relation to the present housing, the extensive landscaping planned and the provision of sufficient noise attenuation protection will be successful in avoiding any significant change in the present living amenities. Consequently, no degradation of existing residential properties is forecast by virtue of the construction of the proposed roadway facility. The relationship of the roadway to present development within the Red Hill Creek Valley is illustrated in Figure 55.

6.2.6 Fiscal Effects

This impact category is concerned with the revenues collected by municipal governments through property taxes. Transportation improvements may cause gains or losses in property tax revenues by affecting property values through areas which they pass or by consumption of land suitable for development.

A change in property values is brought about in one of several ways: by the acquisition of land for highway use which removes land from the tax rolls by changes in the value of land adjacent to the facility and by development of property which is added to the tax rolls.

Tax losses from property taken for roadway use have been estimated directly from current tax assessment data. The direct loss of tax revenue was approximated by applying the current residential mill rate to the average residential assessment. The total estimate was obtained by multiplying the average residential tax by the number of homes to be acquired. The analysis suggests the loss of property taxes would be negligible in any of the affected municipalities.

Estimating property value changes and induced growth effects is difficult. The evidence of past case studies is mixed. Studies of land use and property value changes before and after highway construction show that gains in value have been somewhat more common than losses; however, no consistent pattern has emerged.

Where property values have increased, improved accessibility has been cited as the primary reason. Losses in property values are most frequently attributed to decreases in accessibility due to congestion and increases in noise and air pollution.

In general, the current level of accessibility from the adjacent residential areas to the major collector and arterial street network has been maintained. The travel time between these areas and the present and future employment commercial areas has been improved. The analysis of air pollution and noise

impact suggests the construction of the roadway facility with the appropriate mitigating measures will not adversely affect adjacent property values.

The noise impact analysis suggests the sound exposures on adjacent residential properties can be maintained at an ambient level of 61 dBA (L_{eq24}). Recent research(31) indicates that while a daytime Leq greater than 60 to 65 dBA have caused annoyance, no effect on property values has been determined at these levels. To quote directly, "noise level does not appear to affect housing prices significantly when the daytime Leq is below 70 dBA even where a 10 dBA difference exists between rows of housing".

The construction of this roadway project will provide the necessary roadway capacity to maintain an acceptable level of accessibility to the proposed residential, commercial and industrial development south of the Escarpment. As such, it will provide a positive stimulus to the magnitude and rate of development to increase municipal tax assessment.

Many of the proposed developments, particularly residential expansion, have been predicated on the assumption that this roadway will be built. Land has been acquired and major investments have been made in the sizing and extension of municipal water and sewer improvements. The No-Action alternative would not realize the total potential of these past private and public investments. There is a tendency to view the No-Action alternative as a no-impact case when, in fact, there are definite fiscal impacts that may be avoided by the proposed transportation facility. These effects relate directly to the diversion of through auto and truck volumes from adjacent streets with abutting residential development. The air and noise pollution from this traffic can depress residential property values and commercial activity. The right-of-way provided under the proposed roadway is sufficient to develop noise and visual protection of the abutting residential areas. Under the No-Action alternative, little or no protection can be offered because the existing roadway right-of-way and the access requirements do not provide an opportunity to protect the abutting properties from the noise and visual intrusion.

6.2.7 Regional and Community Plans and Growth

Impacts on regional and community plans and growth occur when a planned transportation facility or its probable impacts are not comptabile with the development goals of a region or a community.

As pointed out under the previous impact assessment factors of "residential activity", "accessibility of facilities and services", "displacement of people", and "fiscal effects", this proposed roadway is completely compatible with, and a component of, the Region's adopted Official Plan. As a result, the proposed facility is projected not to have a detrimental, only a positive, effect under this factor.

When a proposed facility has been incorporated into current planning efforts, the **No-Action** alternative has a significant negative effect. Many community planning actions, such as zoning approvals, roadway plans, and sewer and water extensions have been planned and in some cases implemented in anticipation of this facility. A reversal in the decision to implement the roadway facility will require substantial replanning.

Where a major facility has been delayed for a substantial period of time, a "shadow" effect may occur. When this happens, public and private investment within the corridor tends to be put off until a decisive action or No-Action decision is made. In the interim, the high degree of uncertainty undermines business investment in the area and artificially depresses the real estate market. Through comments received from the public, this "shadow" effect has occurred in the east-west corridor.

6.2.8 Resources and Energy

This impact category deals with the consumption of energy and raw materials by the transportation sector. Resource consumption can be calculated in terms of:

- the energy required to operate vehicles, including cars, trucks and buses;
- the energy consumed in the construction of these vehicles; and
- the energy consumed in the construction of roads.

As an overview, the need and sizing of the proposed facility has been developed compatible with the transportation policies of the Region's Official Plan which place emphasis on the promotion of public transit useage to reduce the use of private transportation. The 2001 vehicle demand forecasts have assumed an ambitious 50 percent increase in the current public transit ridership rate. In summary, the proposed facility does not support the continued current rate of use of the private automobile, but recognizes an optimum balance in the use of public and private transportation modes.

The energy required to operate the projected volume of traffic under the proposed roadway will be less than the No-Action alternative. As a result, the construction of the proposed roadway is a positive approach to reducing energy consumption. This conclusion is based on the consumption rates of vehicle operating on congested arterial streets compared to the projected free flow conditions along completely and semi-controlled access facilities provided under the proposed facility. Current studies[13] indicate a 50 percent difference in consumption rates between congested arterial facilities and high standard roadways with partial or complete access control. Applying these differences in consumption rates over the long-term period results in significant reductions in fuel consumption and cost savings to motorists.

The energy consumption of construction resources is directly represented by the estimated construction costs. Construction costs reflect both labour and material. Labour costs are principally consumed by the local labour force and create a direct benefit in terms of local employment. The consumption of raw materials for construction is not a significant factor as abundant supplies of these materials exist locally.

6.2.9 Scenic Resources, Recreational Resources and Historic Values

This impact category covers changes that occur to the man-made and natural physical spaces and forms of the area, the quality of their interrelationships, their human uses and their historic, aesthetic, cultural and archaeological values. Impacts are caused directly when land is cleared and a new facility is built, and indirectly when noise, air pollution or accessibility changes disrupt the use and appreciation of the area.

The assessment of the magnitude and significance of the impact of the proposed roadway construction under this factor is based on the following documentation:

- analysis of impacts on scenic resources provided in the Phase 3 report;
- archaeological survey and heritage resource assessment completed in Phase 4; and
- recreational master plan for the Red Hill Creek Valley completed in Phase 4.

Scenic Resources

With regard to scenic resources, the assessment was subdivided into four components:

- the east-west roadway above the Niagara Escarpment
- the Niagara Escarpment crossing
- the Upper Red Hill Creek Valley
- the Lower Red Hill Creek Valley and the Red Hill Creek Marsh

All the above can be categorized as urban landscape visual units. The segments are surrounded by relatively intense residential, commercial and industrial development. In all segments, the natural scenic resource has been

disturbed to greater or lesser degree by the present and past surrounding urban development.

The east-west roadway corridor above the Escarpment is surrounded by residential development. This area is rated as low in attractiveness as a natural scenic resource. Where open space provides localized areas with greater scenic value, mitigating measures such as vegetation buffers can alleviate the impacts. In the Albion Falls area, the roadway would be depressed to minimize visual intrusion. The roadway has been located as far south of Albion Falls as possible to further reduce the potential impact. As a result, the roadway impacts on the scenic resources of this unit is considered low.

The wooded Niagara Escarpment is rated as attractive. The natural scenic resource has been disturbed by the present Mount Albion Road crossing and the existing Hydro transmission tower construction. The proposed roadway crossing has been confined to the area of the Mount Albion Road crossing and the Hydro transmission tower construction to minimize the further disruption of this scenic resource. Consequently, the absolute impact of roadway construction is considered moderate due to the present disturbance of the area by development, the confinement of the roadway along established barriers, and provision of vegetation buffers throughout the length of the facility in this area.

In the Upper Red Hill Creek Valley, the ratings for scenic resources vary from "average attractiveness" in open areas to "attractive" in wooded areas. The scenic resources of the Upper Valley are an integral part of the Niagara Escarpment system. South of the T.H. & B. Railway crossings, the scenic view of the Valley is interrupted by roadway and railway crossings. The impact of the roadway construction on the urban scenic resource is significant. Mitigation of the impact has been provided through:

- restriction of the roadway to the east side of the Valley adjacent to the Hydro transmission tower line;
- provision of earth berms and vegetation buffers; and

- maintenance of current pedestrian access from the residential areas to the Valley.

In the Lower Red Hill Creek Valley and the Red Hill Creek Marsh, the scenic resources are rated "average in attractiveness". The present scenic resource is substantially disturbed by the present urban development on each side of the Valley, numerous roadway and railway crossings, and the Queen Elizabeth Way at the northern end of the Valley. The impact of the roadway construction is considered moderate and mitigation is possible.

Recreational Resources

The results of the recreational master plan analysis indicates the potential for recreational development in the Valley will not be precluded by the construction of the proposed roadway. The approximate magnitude of the roadway construction is expressed below:

Type of Open Space	Present Acreage	Residual Acreage
King's Forest Golf Course	180	180
Existing Recreational Areas	76	67
Potential Active Recreation	68	33
Potential Passive Recreation	380	267
Total	704	547

The reduction in the available recreational land totals approximately 22 percent(8).

A review of the recreational space available in adjacent neighbourhoods and communities indicates that only two neighbourhoods on the east side of the Lower Valley, Kentley and Corman, have a shortage of neighbourhood parks and that there is no shortage of community parkland. The upper portion of the Valley contains a large area of presently undeveloped recreational land. This

land has the natural potential to provide numerous passive recreational activities.

A field survey of Valley users was undertaken in order to identify current activities and patterns of recreational use. The survey visitations were selected to offer a balanced cross section of times (day/evening and weekday/weekend). The conclusion that may be drawn is that the Valley is used primarily for passive recreation in a natural urban setting. It is very much a connective link between adjacent land uses and activity nodes. This use of the Valley occurs without the development of facilities to encourage such use.

The spatial distribution of uses in the Valley is uneven. North of Barton Street, very low recreational use occurs (6 percent of the total). From Barton Street to King Street, the use increases (13 percent). From King Street to Albion Falls, a total of 81 percent of the users were observed. Particularly, the area around Albion Falls is heavily used.

These two patterns - type of activity and concentrations of users - suggest a strong existing framework for a recreational master plan. The analysis of supply and demand for recreational space according to the accepted standards for facilities has found an adequate supply of community and neighbourhood space along most of the Valley. Only in two of the neighbourhoods are there existing shortages. There appear to be possibilities to avoid any further impact and to reduce deficits. The areas of concern exist between King and Barton Streets.

The possible Recreation Master Plan[8] as illustrated in Figure 56 has confirmed the viability of maintaining and expanding the recreational use of the Valley in co-existence with the proposed roadway. The desirable objectives for the recreational facility can be achieved. Accordingly, the impact of the proposed roadway construction is considered moderate.

Historic Values

In terms of prehistoric archaeological sites within the corridor, no such cultural remains were encountered which should be studied further, excavated or preserved(32). This is due to the areas under study being heavily disturbed with very little contextual information remaining. As noted previously, few remnants of the early settlement patterns of Barton and Saltfleet Townships exist today. This is largely due to encroachment of urban development from the City of Hamilton. However, a few heritage resources do exist within the corridor areas(23).

These significant structures include an old limekiln on the east side of Upper James Street, south of Limeridge Road, and two structures along Mud Street, east of Mount Albion Road. The latter two structures are an old blacksmith's shop (197 Mud Street), and a residence (158 Mud Street) that was either an inn or the homestead of the Davis family. The Davis family was a prominent loyalist family of settlers in Mount Albion.

The impact on heritage resources is minimal and can be mitigated through relocating these structures, should their removal be feasible. Preliminary estimates for relocating the building at 158 Mud Street are between $12,000 and $15,000, but this estimate could be low depending on the condition of the building.

The blacksmith's shop (197 Mud Street), and the limekiln were roughly estimated to cost $10,000 each to move. The limekiln likely would have to be disassembled to be moved and this involves another tactical problem. The exact destinations of where these buildings would be relocated, and the feasibility from a practical standpoint of moving these structures will have to be determined prior to construction, at the detailed design phase. Thus, these mitigating measures will lessen the impact of the proposed alignment on the heritage resources.

6.2.10 Effects on Natural Environment

An ecosystem consists of living organisms in an area and their non-living or abiotic environment with which they are inseparably interrelated.

Based on the extensive analysis carried out in Phase 3 of the project, adjustments in the roadway alignment were carried out to minimize the disturbance of the terrestrial and aquatic ecosystems. These adjustments principally involved avoidance of major woodlots or their significant fragmentation.

In order to provide input to the Phase 4 studies, a detailed field examination and inventory of the natural environment adjacent to the proposed roadway was undertaken. This generally covered the area between the tops-of-bank on the Red Hill Creek Valley section of the route., and within the reserved right-of-way on the east-west link. The output from the study was a map of habitat types with vegetation and wildlife notations, and an identification of specific natural environment features of significance.

In terms of the general mapping, the area can be divided into three areas. The east-west portion of the route from Highway 403 to the Upper Ottawa Street Landfill consists of disturbed lands with open field communities evident throughout. The Escarpment Area and the Upper Red Hill Creek Valley are much more significant, being covered in an extensive tract of upland hardwoods. The east side of the King's Forest area of the Valley and the Lower Valley predominantly are vegetated with plants indicating disturbed conditions. There are several small areas of higher quality trees along the Valley side slopes.

In Phase 4, 14 features at the microscale of detail were identified. These features are described below and illustrated in Figure 57.

A. Near the Upper Ottawa Street Landfill Site, at Red Hill Creek and the railway tracks: area of good habitat - belted kingfisher, gulls, western chorus frogs, groundhogs, three pairs of cardinals, eastern meadowlark.

B. North of the Landfill Site: mixed, diverse habitat supporting pheasant, western chorus frogs, deer, woodcock, pheasant, squirrels, eastern bluebird, and woodpeckers.

C. North of Albion Falls: nesting for short-eared owl.

D. Valley at Greenhill Avenue: good variety of birds and wildlife, hardwood forest on Valley side.

E. Floodplain between King Street and Queenston Road: floodplain flora and old field vegetation creates good habitat for a variety of birds.

F. Between Barton Street and CNR: small ponds along west side of Creek create habitat not common elsewhere.

G. Near Mount Albion Road and Mud Street: nest for long-eared owl.

H. Upper Gorge: hardwood forest, unusual plants - Green Violet, Small Flowered Cutleaf.

I. Near Barton Street: unusual plants - Cow Parsnip and Water Pennywort.

J. Near Queenston Road: unusual plants - Honewort and Cow Parsnip.

K. Near King Street: unusual trees - Black Walnut and Sycamore.

L. Escarpment at Mount Albion: Flowering Dogwood.

M. Near Albion Falls: short-eared owl.

N. Queen Elizabeth Way: Wetland Cattail, Marsh supports diversity of fauna, particularly birds.

In addition to these features, the habitat types along the alignment have been compiled and specific trees worthy of protection have been identified and documented in the Phase 3 analysis.

As a result of the interactive planning process carried out in Phase 4, five of the above areas, Features C, D, G, H and M have been completely avoided through the refinement of the roadway alignment. Of the remaining areas, the impact on all but two is considered moderate.

Features E, F, I and J occur within the Lower Valley, from King Street north. They include pockets of diverse habitat, mixing wet depressions with lowland trees, supporting flora and fauna of interest. The road will consume most of the land in the Lower Valley. However, various interconnected pockets will continue to exist. Thus, the impact can be mitigated by conserving these pockets and providing new ones where possible. This would require a more detailed ecological design during final design and construction of the road. Since the natural features, particularly plants, are those of disturbed species (not sensitive), this task does not require a high degree of sophistication to execute.

Features J and L are plant specimens of interest. Feature L includes an area of unusual showy Dogwood. The alignment of the road and salvage transplanting will retain these plants in the area. Feature K includes several large trees (Black Walnut, Sycamore). Transplantation is probably too difficult. Thus if, in the final design, the trees cannot be retained, they will be lost.

At the Upper Ottawa Street Landfill Site (Feature A), the roadway alignment has been kept as close as possible to the Landfill Site to minimize the fragmentation of the existing woodlot. A minor stream diversion is planned for the Red Hill Creek in this location. As the wildlife present is principally avaian wildlife and urban tolerant mammals, reptiles and amphibians, the

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impact of road construction and maintenance on terrestrial wildlife is projected to be moderate.

The impact on the Red Hill Creek Marsh (Feature N) will be signficant and difficult to mitigate. However, in assessing significance, the impact of the proposed construction was viewed in relation to the existence of the Queen Elizabeth Way and the planned expansion of the Queen Elizabeth Way between Burlington Street and Highway 20.

The Marsh area is presently highly distributed by virture of being adjacent to the Queen Elizabeth Way, the construction of the HEPC transmission towers and the CNR spur line to Lang's Foods. The planned interchange has been restricted to the south side of the railway to restrict the disruption to approximately half of the present Marsh area. The significance of the additional impact due to the construction of another interchange in this area must be viewed in this context.

With respect to general mitigation measures, the Ministry of Transportation and Communications manual, Highway Construction Practices and Potential Environmental Concerns (revised 1980), will provide adequate guidance for protecting the general environment of the roadway during construction.

6.2.11 Air Quality

There are several measurable pollutants generated by internal combustion engines. One of these, CO (carbon monoxide), has been found in studies of air quality to exceed recommended levels at distances from the source consistently in excess of the distances for other pollutants.

On this basis, the evaluation projected only CO levels. A computer model at the Air Resources Branch of the Ministry of the Environment was used to carry out the calculations. The model took into account the peak-hour volume and speed of the traffic and the percentage of truck traffic. The traffic volumes from the most heavily travelled section of the proposed roadway were used.

The results of the calculation indicated that, at a distance of 20 m from the pavement edge, a CO concentration of 6 parts per million would be exceeded only 1 percent of the time. The calculations also indicated that the maximum concentration would be 18 p.p.m.

The regulations of the Environmental Protection Act establish "desirable ambient air quality criteria". The criteria for CO is 30 p.p.m. over a one-hour period. On this basis, it was concluded that the impact on air quality is not significant as the magnitude of the change is small and further, it is restricted within the roadway right-of-way.

6.2.12 Noise Impacts

An in-depth investigation(33) of noise pollution was undertaken in Phase 4 of the project. The assignment included refinement of the magnitude, incidence and significance of the potential noise impacts and the possible strategies to mitigate the effects.

East-West Corridor

The noise impact along the Mountain East-West Arterial is projected to be relatively minor and generally insignificant as a result of the implementation of the new roadway. Based on field measurements, it was concluded that this area experiences sound exposures in the range of 50 to 55 dBA (L_{eq24}). With the planned earth berming, the projected noise level changes can be retained within the road allowance and dedicated easements. This conclusion is supported by the data provided in Table 6.6.

North-South Corridor

The existing environment in or beside the Red Hill Creek Valley was found to be very quiet at the southern portion (King's Forest Park). North of the T.H. &

Table 6.6

SUMMARY OF NOISE IMPACT ANALYSIS

MOUNTAIN EAST/WEST ARTERIAL SEGMENT

Section	Existing* Noise Level	Future** Noise Level	Projected Change
Upper Horning Road - Upper James Street	51-55	53-56	0-4
Upper James Street - Upper Sherman Avenue	50-53	52-61	0-9
Upper Sherman Avenue - Upper Ottawa Street	50-55	55-63	0-5
Upper Ottawa Street - CNR	41-52	56-57	9-10

*All noise levels expressed as L_{eq24} (dBA)

**Estimated noise level with mitigation effect of acoustical barriers

Note: Ministry of Housing, Ontario "Guidelines on Noise and New Residential Development Adjacent to Freeways" stipulate the following:

- the objective for predicted sound levels in outdoor recreational areas is 55 dBA or less.
- residential development will be prohibited where the attenuated sound level in outdoor recreational areas will exceed 70 dBA.

B. Railway crossing, higher sound exposures exist typical of an urban area, primarily as a result of the existing road network. North of Barton Street, the adjacent development is industrial. Noise impact on industrial and commercial land use is not considered of concern. Consequently, the analysis focused on the section through the Red Hill Creek Valley from Albion Falls to Barton Street.

The existing and planned recreation areas within the King's Forest Park area and adjacent residential properties are projected to experience significant increases in sound exposures of up to 15 dBA. However, noise mitigation is possible to produce reductions of 8 to 12 dBA and thus, it will be possible to maintain the resulting ambient noise level in the residential areas adjacent to the facility within the acceptable standards established by the Ministry of the Environment and the Ministry of Municipal Affairs and Housing.

Table 6.7 summarizes the incidence and magnitude of noise exposure changes on the residential households located adjacent to the facility. The significance of the impact has been assessed in comparison with the adopted standards. As virtually all the increase in the noise exposure can be contained within 60 dBA ($L_{eq_{24}}$) consistent with normal urban conditions, the impact is considered acceptable.

Table 6.7

SUMMARY OF NOISE IMPACT ANALYSIS

NORTH/SOUTH FREEWAY SEGMENT

Section	Existing* Noise Level	Future** Noise Level	Projected Change
CNR - Mud Street	52	56	4
Mud Street - Greenhill Avenue	47-54	54-61	7-12
Greenhill Avenue - King Street	47-52	57-62	5-10
King Street - Queenston Road	52-59	56-62	1-10
Queenston Road - Barton Street	56-59	56-61	1-4
Barton Street - CNR	56-62	59-66	1-4

*All noise levels expressed as L_{eq24} (dBA)

**Estimated noise level with mitigation effect of acoustical barriers

Note: Ministry of Housing, Ontario "Guidelines on Noise and New Residential Development Adjacent to Freeways" stipulate the following:

- the objective for predicted sound levels in outdoor recreational areas is 55 dBA or less.
- residential development will be prohibited where the attenuated sound level in outdoor recreational areas will exceed 70 dBA.

7. OUTLINE OF PUBLIC INVOLVEMENT PROGRAM

Throughout the various stages of the investigation, consultation with those likely to be affected by the undertaking was actively sought and encouraged. At the outset, a total of 90 specific individuals and organized interest groups were identified. These groups were kept informed during the course of the investigation.

The major part of the program was focused around three series of public information centres. These information centres were advertised through the news media and the distribution of public brochures. This forum was effective in providing an opportunity for the mutual exchange of information. The public was given an opportunity to be informed of the technical planning and decision-making process. The project staff in return gained an appreciation of public concerns, attitudes and priorities.

7.1. EXTENT AND TIMING OF PUBLIC CONTACT

The first series of public information centres was held in July, 1978 to outline the following:

- the existing and planned development;
- the projected travel demand forecasts;
- the estimated deficienies of the present road network; and
- the various constraints affecting the development of optional roadway systems.

The information centres were advertised in the local media. Public brochures were distributed to 200 groups and individuals and were available in the major public buildings. The brochure is illustrated overleaf.

Two public information centres were provided at the following locations:

Location	Date and Time	Recorded Attendance
Cardinal Newman High School 33 Cromwell Cr.	Monday July 10, 1978 2:00 p.m. to 9:00 p.m.	34
Hill Park School 465 East 16th St.	Tuesday July 11, 1978 2:00 p.m. to 9:00 p.m.	40

The response to the questionnaire included with the brochure was limited. Of the total distributed, 50 were returned. Of those returned, 75 percent were from the Upper Kenilworth Avenue area. These citizens were very concerned about truck traffic. They considered the reduction of truck and auto traffic within residential areas to be the most important benefit of an improved road system.

For Phase 3 a comprehensive public information program was developed. The objectives of the program were:

i) To provide special interest groups and the general public with the opportunity to review the impact assessment carried out related to comprehensiveness and objectivity.

ii) To allow the public to offer their preference regarding the six alternatives, the basis for their selection, any any possible modifications which would make their preferred option more attractive.

iii) To permit the special interest groups and the general public to be aware of the concerns and options of other groups in order to establish a basis for possible future trade-offs and compromise.

questionnaire

A major roadway project may create significant changes in the surrounding development. Experience indicates the following list of considerations are of repeated concern in new roadway planning. However, you may not consider the list complete. Please add others as necessary.

Examine the list closely, including those you may have added. Assign points to each of the statements depending on your opinion of its relative importance. Be sure that the sum of the points assigned equals 100. The more points given to a particular statement indicates a greater importance or priority.

	Points
1. Reduce travel time to work, shopping and recreation area.	
2. Reduce through auto and truck traffic within residential areas.	
3. Minimize relocation of families in building new roadways.	
4. Preserve open space and natural recreation areas.	
5. Minimize impact on your property taxes.	
6. Encourage orderly growth and development within your community.	
7. Promote expansion and improvement of public bus services.	
8. _____	
_____	
9. _____	
_____	
Total	100

Name _____

Address _____

Additional Comments: _____

_____

_____

_____

_____

_____

If you wish to forward additional comments or suggestions, send to:

REGIONAL ENGINEERING DEPARTMENT,
City Hall,
Attention Corridor Study,
71 Main St. W., HAMILTON, Ont., L8N 3T4.

study schedule

march, 1978

future road needs

we are here

june, 1978

preliminary alternatives

september, 1978

evaluation of viable alternatives

january, 1979

selection and staging of preferred option

what will be considered in the evaluation of alternatives?

The type, size and location of a roadway create both positive and negative impacts on people, the physical environment and the natural environment. Information on the transportation aspects of the alternative is the major aspect of measuring the effects of its construction.

The relationship between the transportation factors and the effects on people, places and the natural environment is summarized below:

RELATIONSHIP OF TRANSPORTATION FACTORS BY IMPACT CATEGORY

Impact Categories	Size & Location of Road	Road Maintenance Methods	Mix of Auto & Truck Traffic	Magnitude / Orientation of Traffic	Degree of Access
Social Impacts					
•People and Property	X				
•Noise	X		X		
•Visual Intrusion	X		X		
•Travel Time	X		X	X	X
•Cultural, Historic and Recreational Areas	X				
Economic Impacts					
•Business Activity	X		X		X
•Property Taxes	X				X
•Future Growth	X			X	X
Environmental Impacts					
•Wildlife	X	X	X		
•Vegetation	X	X	X		
•Air Quality	X		X		
Engineering					
•Cost	X	X			X
•Effect on Road and Transit System	X			X	X

REGIONAL MUNICIPALITY OF HAMILTON - WENTWORTH

mountain east · west / north · south corridor study

Highway 403 to the Q.E.W.

public information centres

2 p.m. to 9 p.m.

monday, july 10
cardinal newman high school - 33 cromwell cr.

tuesday, july 11
hill park school
465 east 16th street

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HAMILTON, ONTARIO

why the study ?

who is working on the project ?

what are the objectives ?

what has been completed to date ?

how can you participate ?

The program consisted of six components:

- A presentation to the elected representatives of Regional and local Councils on May 10, 1979.

- A preview meeting on May 10, 1979 with the executive of the identified local ratepayer groups. At this meeting, these representatives were requested to attend the public information centres.

- A media presentation to the local press, radio and television representatives on May 10, 1979. Suitable graphic material was made available to assist the media in their presentations. Coincident with the media release, a large newspaper advertisement appeared in the local press on May 12 and May 19. The advertisement included the status of the project, a description of the six alternatives, the impact assessment and a questionnaire. The questionnaire asked the reader to respond indicating his route preference.

  A public information package was distributed to those included on the mailing list. It included an outline of the investigation process, the results of Phase 1 and 2, a description of the short-listed alternatives and detailed evaluation procedure. Two thousand of these information packages were distributed to the public.

- Five public information centres were held at the following locations:

May 14, 1979	Our Lady of Lourdes School 420 Mohawk Road, East	(2:00 - 9:00 p.m.)
May 15, 1979	Rosedale Arena 100 Greenhill Avenue	(2:00 - 9:00 p.m.)
May 16, 1979	Woodward Public School 575 Woodward Avenue	(2:00 - 9:00 p.m.)
May 17, 1979	Mount Albion School 2121 Kennard Street	(2:00 - 9:00 p.m.)
May 18, 1979	City Hall	(2:00 - 9:00 p.m.)

These were held geographically throughout the study corridor. Graphic displays, public brochures and questionnaires were provided at these information centres.

- A television program was aired on May 31, 1979. The one-half hour program outlined the study procedure, the projected road deficiencies and the six short-listed alternatives.

- At a special meeting of Regional Council on July 18, 1979, organizations and individuals were afforded an opportunity to voice their opinion directly to Regional Council. In total, 32 briefs were presented.

At the open-house sessions, 1,800 questionnaires were distributed. Approximately 400 questionnaires were received together with 753 returns from the newspaper advertisement.

The purpose of this third series of public meetings during Phase 4 was to explain the engineering details associated with the preferred option, its positive impacts, how the negative impacts will be minimized and how the proposed roadway facility will be integrated with the recreational Master Plan developed for the Red Hill Creek Valley. Four public information centres were provided at the following locations:

Date	Location	Attendance
Monday June 23, 1980	Roxborough Park School 20 Reid Avenue North	117
Tuesday June 24, 1980	Albion Public School 350 Albright Road	102
Wednesday June 25, 1980	Mount Albion School 2121 Kennard Street	65
Thursday June 26, 1980	Hill Park Secondary School 465 East 16th Street	70

The information centres were advertised through the news media, and by means of public brochures which were distributed to 200 groups and all individual citizens attending these meetings. The opinions of the residents attending were obtained through written comments and the response to a questionnaire.

7.2 SUMMARY OF PUBLIC REACTION AND COMMENT

As indicated, the attendance at the first series of information centres was limited. This may be explained by the lack of concrete proposals to react to. The second series of information centres held during the Phase 3 portion of the project provided an improved basis to gauge public preference.

The Phase 3 questionnaire allowed the public to comment on the following:

- the comprehensiveness of the process
- their preference amongst the six short-listed roadway expansion options; and
- the relative importance of the evaluation factors

The questionnaire is reproduced overleaf and the analysis of the response is given in Table 7.1. The response to the similar questionnaire provided in the newspaper advertisement is summarized in Table 7.2.

Table 7.1

SUMMARY OF RESPONSE TO QUESTIONNAIRE - July 31st, 1979
(PUBLIC INFORMATION PACKAGE)

1. Do the 16 Factors Listed Provide Sufficient Information to Make a Decision?

Yes	No	No Response	Total
265 (66%)	100 (25%)	34 (9%)	399 (100%)

2. Which of the Six Alternatives do you Prefer?

	1st Choice		2nd Choice		3rd Choice		None
Alt.	2	28	2	52	2	29	81
	3	81	3	32	3	15	
	4	70	4	44	4	36	
	10	58	10	66	10	12	
	11	38	11	66	11	49	
	15	15	15	6	15	29	

3. Which of the 16 Listed Factors were Most Important to You?

		Response	Rank
2.	Noise	146	1
11.	Natural Environment	115	2
7.	Air Quality	86	3
1.	Property Displacement	76	4
6.	Recreation/Open Space	74	5
5.	Community Disruption	72	6
14.	Safety	64	7
10.	Development Potential	60	8
4.	Regional Accessibility	52	9
15.	Service to Truck Traffic	35	11
13.	Flexibility	30	12
12.	Scenic Resources	22	13
8.	Impact on Business	20	14
9.	Property Tax Impact	14	15
16.	Impact on Transit	6	16

Table 7.1
(cont'd)

4. Response by Community

Alt.		1st Choice						2nd Choice						3rd Choice					
		2	3	4	10	11	15	2	3	4	10	11	15	2	3	4	10	11	15
1	Stoney Creek (north of Escarpment)	2	2	-	2	1	-	-	1	2	1	2	-	1	1	2	-	1	1
2	Stoney Creek (south of Escarpment)	3	6	7	-	1	2	6	4	5	2	-	-	4	2	1	2	2	-
3	Vincent/Red Hill/Gershome	-	6	2	31	13	1	2	2	2	28	29	1	7	1	1	2	15	6
4	Nashdale/Kentley/Corman/ Greenford	4	18	6	-	1	6	14	9	7	1	-	1	8	2	16	-	6	-
5	McQuesten/Parkview/ Glenview East	6	4	1	2	3	3	2	4	3	3	2	-	1	1	2	1	5	2
6	Homeside/Bartonville/ Normanhurst/ Glenview West	-	1	-	3	1	-	1	-	1	1	3	-	-	-	-	-	-	-
7	Rosedale	-	-	-	8	2	3	-	-	-	4	8	-	-	1	-	2	1	3
8	Sherwood/Huntington	1	6	5	1	3	-	5	2	4	1	-	-	-	3	3	-	2	1
9	Mountain (bounded by Mohawk, Upper James, Limeridge & CNR)	2	5	2	1	-	-	-	1	2	3	2	-	-	-	-	2	-	3
10	Mountain (south of Limeridge, east of Upper James)	-	6	5	4	-	-	1	-	4	2	4	-	3	-	1	-	1	-
11	Mountain (south of Limeridge, west of Upper James)	1	2	10	-	1	-	1	2	-	2	1	-	-	-	2	-	3	1
12	Mountain (bounded by Mohawk, Upper James, Limeridge, Upper Horning)	2	5	21	-	-	1	6	1	1	3	4	1	2	1	2	2	1	6
13	Mountain (north of Mohawk to Brow)	1	4	3	-	1	-	8	3	1	2	1	-	2	-	3	-	3	4
14	Central City	1	3	2	1	2	-	-	1	1	3	2	1	2	1	-	-	1	-
15	Westdale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	Ancaster	2	2	2	-	-	-	-	2	1	-	2	-	1	-	-	-	1	1
17	Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 7.2

SUMMARY OF RESPONSE TO QUESTIONNAIRE - July 31st, 1979

(NEWSPAPER ADVERTISEMENT)

TOTAL NUMBER OF QUESTIONNAIRES RECEIVED - 753

Alternative	First Choice	Second Choice	Third Choice	None
2	17	70	35	
3	145	37	10	
4	83	22	39	
10	31	29	13	
11	19	66	55	
15	7	9	27	—
Total	302	233	177	46

Tear Along Dotted Line

WHAT DO YOU THINK?

MOUNTAIN EAST - WEST AND NORTH - SOUTH CORRIDOR STUDY

IN REVIEWING THE SUMMARY OF THE IMPACT ASSESSMENT,

- DO YOU BELIEVE THE 16 FACTORS LISTED ON PAGES 8 AND 9 PROVIDE SUFFICIENT INFORMATION TO MAKE A DECISION? YES ☐ NO ☐

- IF NO, WHAT ADDITIONAL FACTORS DO YOU BELIEVE SHOULD BE ADDED?

1. _____
2. _____
3. _____
4. _____
5. _____

- IN GENERAL, OF THE 6 ALTERNATIVES SHOWN IN THE EXHIBITS, WHICH DO YOU PREFER?

FIRST CHOICE: ALTERNATIVE ____
SECOND CHOICE: ALTERNATIVE ____
THIRD CHOICE: ALTERNATIVE ____

- ARE THERE ANY MODIFICATIONS WHICH WOULD MAKE YOUR FIRST CHOICE MORE ACCEPTABLE?

_____
_____
_____

- IN REACHING YOUR DECISION, WHICH WERE THE THREE MOST IMPORTANT FACTORS TO YOU OF THE 16 FACTORS LISTED ON PAGES 8 AND 9?

FIRST MOST IMPORTANT: FACTOR NO. ____
SECOND MOST IMPORTANT: FACTOR NO. ____
THIRD MOST IMPORTANT: FACTOR NO. ____

OTHER COMMENTS _____
_____
_____

NAME OF YOUR COMMUNITY OR AREA:
NUMBER OF YOUR AREA: (SEE REVERSE SIDE FOR MAP OF AREA NUMBER DESIGNATION)

MAIL TO: REGIONAL ENGINEERING DEPARTMENT
CITY HALL
ATTENTION: CORRIDOR STUDY
71 MAIN ST. W., HAMILTON, ONT., L8N 3T4

IF YOU WISH TO BE ADDED TO OUR MAILING LIST:

NAME: ADDRESS:
POSTAL CODE:

A total of 73 letters was received from individual citizens, organized interest groups, and private enterprise. A summary of these letters is outlined below:

Letters in Favour of New Road Construction

No. of Letters	Address	
16	Kenilworth Avenue South	
1	Wabco	
1	Battlefield Drive	
1	Hamilton Automobile Club	
1	Metropolitan Hamilton Real Estate Board	
1	Centennial Parkway Ratepayers Group	- 621 signatures
1	Hamilton & District Home Builders' Association	
1	Starward Homes	
1	King Street East	
1	Kenilworth Avenue South	- signed by 35 other residents
2	Websters' Road	
1	Parkdale Avenue	
1	Kronas Real Estate	
1	Audubon Street	- petition signed by 6 names
1	Upper Paradise	
31		

Of these letters, the major reasons for favouring the construction is given below:

- reduction of noise on existing streets
- reduction of truck traffic on present road network
- reduction of accidents by decreasing volume of traffic on existing streets

- support growth and development of the Region
- minimize road user costs
- reduction of vehicle emissions

Letters in Opposition to New Road Construction

No. of Letters	Address	
2	Glen Castle Drive	
1	Reimer Court	
1	Mud Street	
1	Brookstream Court	
1	Hamilton Naturalists' Club	
1	Partridge Drive, Burlington	
1	United Electrical Radio & Machine Workers of America	
1	Glenmurray Court	
1	Glen Castle Drive	- signed by 15 other residents
1	Peace Court	
1	Bruce Trail Association	
1	Embury Court	
1	Elkwood Drive	
1	Cope Avenue	
1	Auburn Avenue	
1	Beland Avenue	
1	Brookstream Court	
1	Queenston Road	
1	Limeridge Road	- proposing Alternative 4
1	St. David's United Church	
1	Beland Avenue	
1	Talbot Street	
1	Barons Avenue	
1	Lucerne Avenue	
1	Beland Avenue	
1	Glencarry Avenue	

No. of Letters	Address	
1	Armstrong Place	-
1	Architectural Conservancy of Ontario	
1	Hayes Avenue	
1	Limeridge Road	
1	Limeridge Road	- petition with 451 signatures
1	Beland Court	
1	Lucerne Avenue	
3	Beland Avenue	
1	Nugent Drive	
1	Talbot Street	
1	Hamilton & District Labour Council	
1	Emerson Street	
1	Elkwood Drive	- favours Alternative 4
31		

Of these letters, the major issues cited for opposing the construction were as follows:

- population growth will not be achieved
- energy crisis will reduce travel
- need to protect and preserve parkland, historic buildings in order to maintain quality of life and to provide for educational purposes
- reduction of property value of properties adjacent to new road
- need can be met through carpooling, flexi-hours and improved public transit
- lack of recreation space in each end of City of Hamilton
- disruption of access to schools and to parkland; concern over creation of a physical barrier

The Phase 4 public information program provided the public with detailed information on the selected alternative and introduced a possible recreation master plan for the Red Hill Creek Valley. The comments and opinions of the

public were recorded through the response to the questionnaire distibuted at the information centres. The tabulation of the major comments received under each questionnaire is summarized below. In total, 120 questionnaires were completed.

Question 1 - Comments Regarding the Proposed Roadway Proposal

- disapprove of Red Hill Creek Valley location (20 of 89 responses)
- freeway is needed (8 of 89 responses)
- roadway location will have severe impact on people living adjacent to the facility (7 of 89 responses)
- in agreement and consider it well planned (11 of 89 responses)
- Mount Albion Road should not be closed at King Street (8 of 89 responses)

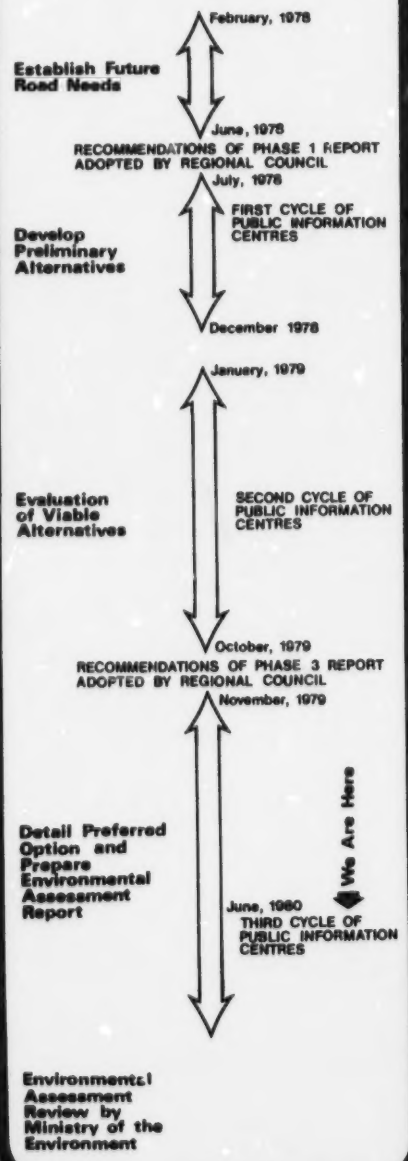
Question 2 - Which of the following issues were most important to you?

1.	Traffic noise	-	58
2.	Effect on vegetation and wildlife	-	51
3.	Visual appearance	-	45
4.	Effect on potential recreational land	-	44
5.	Access to your home and work	-	37
6.	Pedestrian circulation	-	18
7.	Property requirements	-	14
8.	Proximity to schools	-	14

Question 3 - Do you consider the proposed recreational master plan to be:

Good/Acceptable	-	54
Unacceptable	-	41

STUDY SCHEDULE AND PROJECT STATUS


February, 1978
Establish Future Road Needs
June, 1978
RECOMMENDATIONS OF PHASE 1 REPORT ADOPTED BY REGIONAL COUNCIL
July, 1978
FIRST CYCLE OF PUBLIC INFORMATION CENTRES
Develop Preliminary Alternatives
December 1978
January, 1979
Evaluation of Viable Alternatives
SECOND CYCLE OF PUBLIC INFORMATION CENTRES
October, 1979
RECOMMENDATIONS OF PHASE 3 REPORT ADOPTED BY REGIONAL COUNCIL
November, 1979
We Are Here
Detail Preferred Option and Prepare Environmental Assessment Report
June, 1980
THIRD CYCLE OF PUBLIC INFORMATION CENTRES
Environmental Assessment Review by Ministry of the Environment

STUDY PURPOSE

Expanded transportation facilities will be required to support the growth projected in the current land-use planning for the Region. A substantial portion of this growth is anticipated south of the Escarpment in Hamilton and Stoney Creek.
Through forward planning, the possible adverse impacts on existing and planned development created through construction of new roadways can be minimized. Further, the provision of additional roadways can reduce the effects of through-traffic and industrial traffic within neighbourhoods.

STUDY OBJECTIVES

- To establish the need, scope, and timing of a new roadway link between Highway 403 across the Mountain connecting to the Q.E.W. in the eastern part of Hamilton or Stoney Creek.

- To identify all reasonable options which satisfy the projected travel demand, and to quantify the probable effects on the natural, social, economic, and transportation environments.

- To prepare plans for the preferred alternative detailing property requirements, costs, and methods to reduce the effects on the surrounding areas.

PROJECT STATUS

- Phase 1 completed in June 1978 confirmed a new roadway link crossing the Escarpment is required to support the projected growth in the Region. A deficiency of 3 arterial lanes in the peak direction is predicted, notwithstanding a 50 percent increase in the rate of transit useage.

- 15 roadways options were examined. 6 alternatives were selected and reviewed with the public. Based on an in-depth evaluation, a Preferred Option was recommended and approved by Regional Council at the conclusion of Phase 3 in October 1979. The Preferred Option is illustrated overleaf.

- The investigation is now proceeding to prepare detailed functional plans to identify property requirements, costs, and methods to enhance the positive potential of implementation and minimize the disruption created by construction.

ON-GOING WORK

Once the planning is finalized, an Environmental Assessment Document will be prepared and submitted to the Ministry of the Environment for examination under the requirements of the Environmental Assessment Act. Further public hearings may be required prior to a decision being reached by the Ministry of the Environment.

ADDITIONAL INFORMATION

1. Plan to attend one of the public information centres listed and complete the questionnaire provided.
2. For further information, contact Mrs. Ruth Stewart at 526-4404.
3. Send your written comments and suggestions to:
   Corridor Study,
   Regional Engineering Department, City Hall,
   71 Main Street West,
   HAMILTON, Ontario, L8N 3T4.

THE REGIONAL MUNICIPALITY OF HAMILTON - WENTWORTH

MOUNTAIN EAST - WEST AND NORTH - SOUTH CORRIDOR STUDY

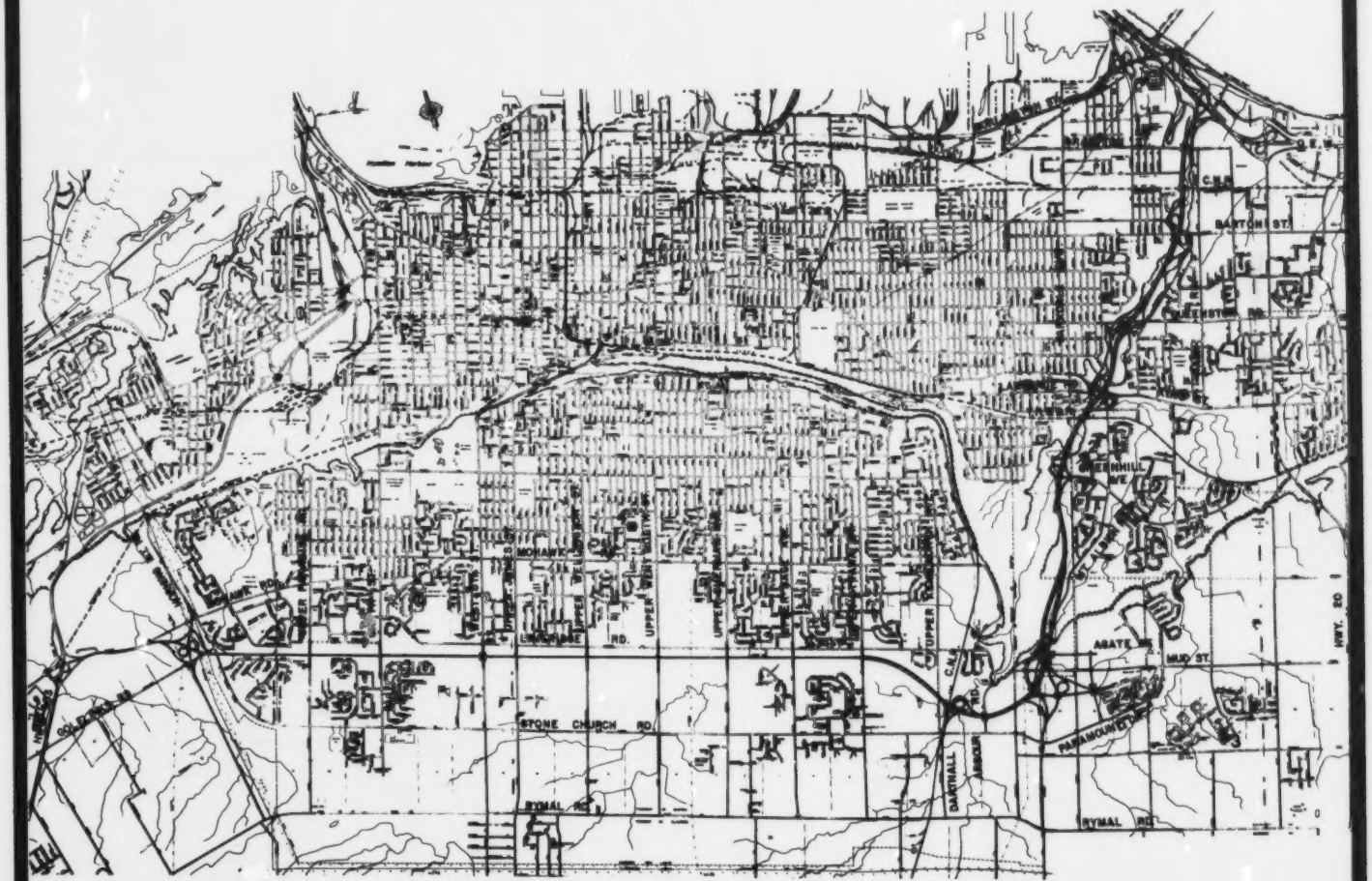
PUBLIC INFORMATION BROCHURE

PHASE 4 : DETAILING OF PREFERRED OPTION

PUBLIC INFORMATION CENTRES

2 p.m. to 9 p.m.

1. **Monday, June 23**
   ROXBOROUGH PARK SCHOOL
   20 REID AVENUE NORTH
2. **Tuesday, June 24**
   ALBION PUBLIC SCHOOL
   350 ALBRIGHT ROAD
3. **Wednesday, June 25**
   MOUNT ALBION SCHOOL
   2121 KENNARD STREET
4. **Thursday, June 26**
   HILLPARK SECONDARY SCHOOL
   465 EAST 16th STREET



MOUNTAIN EAST-WEST AND NORTH-SOUTH CORRIDOR STUDY

■ LOCATIONS OF PUBLIC INFORMATION CENTRES

PREFERRED OPTION

MOUNTAIN EAST - WEST AND NORTH - SOUTH CORRIDOR STUDY

PHASE 4: DETAILING OF PREFERRED OPTION

PUBLIC INFORMATION CENTRE QUESTIONNAIRE

MONDAY, JUNE 23	☐	ROXBOROUGH PARK SCHOOL
TUESDAY, JUNE 24	☐	ALBION PUBLIC SCHOOL
WEDNESDAY, JUNE 25	☐	MOUNT ALBION SCHOOL
THURSDAY, JUNE 26	☐	HILL PARK SECONDARY SCHOOL

1. DURING THE DETAILED PLANNING OF THE SELECTED ROADWAY ALTERNATIVE, EFFORTS HAVE BEEN MADE TO MINIMIZE THE IMPACT OF THE ROADWAY ON THE ABUTTING RESIDENTIAL, COMMERCIAL, AND OPEN SPACE DEVELOPMENT. DO YOU HAVE ANY COMMENTS REGARDING THE PROPOSAL?

_____

_____

_____

_____

_____

2. IN MAKING THESE SUGGESTIONS, WHICH OF THE FOLLOWING ISSUES WERE MOST IMPORTANT TO YOU?

ACCESS TO YOUR HOME AND WORK	☐
PROPERTY REQUIREMENTS	☐
TRAFFIC NOISE	☐
VISUAL APPEARANCE	☐
PEDESTRIAN CIRCULATION	☐
EFFECT ON POTENTIAL RECREATIONAL LAND	☐
PROXIMITY TO SCHOOLS	☐
EFFECT ON VEGETATION AND WILDLIFE	☐
OTHER (PLEASE DESCRIBE)	☐

_____

3. THE RECREATIONAL MASTER PLAN HAS OUTLINED THE POSSIBLE RECREATIONAL DEVELOPMENT WITHIN THE RED HILL CREEK VALLEY COMPATIBLE WITH THE CONSTRUCTION OF A ROADWAY. DO YOU CONSIDER THE PROPOSED PLAN TO BE GENERALLY:

GOOD	☐
ACCEPTABLE	☐
UNACCEPTABLE	☐

HOW COULD IT BE IMPROVED?

_____

_____

_____

_____

4. WHAT ISSUES DO YOU FEEL SHOULD BE INVESTIGATED FURTHER?

_____

_____

_____

_____

5. OTHER COMMENTS:

_____

_____

_____

PLEASE LEAVE YOUR COMPLETED QUESTIONNAIRE WITH THE PROJECT STAFF BEFORE LEAVING THE INFORMATION CENTRE OR MAIL TO:

REGIONAL ENGINEERING DEPARTMENT,
CITY HALL,
ATTENTION: CORRIDOR STUDY,
71 MAIN STREET WEST, HAMILTON, ONTARIO, L8N 3T4.

Question 4 - What issues should be investigated further?

- no further issues should be investigated (8 of 96)
- the need for the proposed roadway (9 of 96)
- the effect on the natural and man-made environment (6 of 96)
- other north - south alternatives (22 of 96)
- the devaluation of adjacent residential property (6 of 96)
- the need to close Mount Albion Road at King Street (7 of 96)

Question 5 - Other Comments

The written comments received under this question did not raise any additional issues, but rather tended to expand on the comments provided in the previous four questions.

7.3 OUTLINE OF APPROVAL PROCESS

Throughout the investigation, approval was received by the Study Team to proceed with the next phase of the assignment. This ensured the procecdures were responsive to the requirements of the elected representatives and the general public.

At the conclusion of Phase 1, the findings of the Study Team were approved by the Steering Committee on June 28, 1978 and the permission was given to proceed into Phase 2.

The comparative impact assessment prepared for the six alternatives together with the evaluation result was presented to the councillors of the area municipalities of Stoney Creek, Ancaster, and Hamilton during the month of June, 1979. They were asked to submit their comments and concerns about the six alternatives together with a preferred alternative through their representatives on Regional Council.

Public briefs were requested from organized interest groups and individuals. At a special meeting of Regional Council, July 18, 1979, 32 written briefs and 7 verbal presentations were given regarding the recommendation of the Steering Committee to select Alternative 2 as the preferred option. The Study Team prepared a comprehensive response to each of the issues raised in the public briefs. This report was reviewed by the Steering Committee and the initial decision was reaffirmed and recommended that functional planning for Alternative 2 be carried out in conjunction with the master planning of recreational facilities in the Red Hill Creek Valley. The Steering Committee's recommendation was presented and endorsed by Regional Council on September 29, 1979.

The contents of this environmental assessment submission was presented and endorsed by Regional Council, November 16, 1982.

APPENDICES

APPENDIX A
REFERENCES

1. The Regional Municipality of Hamilton-Wentworth Planning Department. "The Hamilton-Wentworth Regional Official Plan", 1980.

2. The Regional Municipality of Hamilton-Wentworth. "Mountain East-West and North-South Corridor Study. Phase 1 - Future Road Needs and Data Collection", July, 1978.

3. The Regional Municipality of Hamilton-Wentworth. "Mountain East-West and North-South Corridor Study. Phase 2 - Preliminary Evaluation of Alternatives", January, 1979.

4. The Regional Municipality of Hamilton-Wentworth. "Mountain East-West and North-South Corridor Study. Phase 3 - Detailed Impact Assessment and Evaluation", August, 1979.

5. The Regional Municipality of Hamilton-Wentworth. "Mountain East-West and North-South Corridor Study. Summary Report - The Need, the Alternatives, the Recommended Facility", July, 1979.

6. Study Team, "Response to Public Briefs Presented July 18, 1979 to Regional Council", July, 1979.

7. The Regional Municipality of Hamilton-Wentworth. "Mountain East-West and North-South Corridor Study. Phase 4 - Functional Planning of Preferred Option", September, 1981.

8. Ecologistics Limited. "Red Hill Creek Valley - Proposed Recreation Master Plan", January, 1982.

9. Regional Planning Department. "Hamilton-Wentworth Population Projections: 1981 Review", September, 1981.

10. Regional Planning Department. "Working Paper - 2001 Travel Demand Projections", August, 1982.

11. Regional Planning Department. "An Action Plan for Economic Growth, 1978".

12. Peter Barnard Associates. "An Industrial Land Development Strategy for Hamilton-Wentworth", October, 1981.

13. Transport Canada. "The Future of the Automobile in Canada", April, 1979.

14. Ministry of Transportation and Communications. "Motor Vehicle Accident Facts 1979", 1979.

15. Ministry of Transportation and Communications. "1977 Traffic Volumes", 1977.

16. City of Hamilton Planning Department. "Official Plan Amendment No. 228", 1968.

17. Ministry of Transportation and Communications. "Traffic Control Signal Timing and Capacity Analysis at Signalized Intersections", 1976.

18. City of Hamilton Traffic Department. "Trucks in the City of Hamilton", 1973.

19. DeLCan. "RMOC State-of-the-Art Truck System Review", May, 1978.

20. Regional Planning Department. "Travel Characteristics Survey", 1975.

21. City of Hamilton, IBI Group, "Hamilton Transportation Strategy Study", Volume 1 and Volume 2, June, 1973.

22. Regional Planning Department. "Cordon Survey", 1981.

23. DeLCan. "Heritage Resources Documentation", July, 1982.

24. City of Hamilton Planning Department. "Official Plan Amendment No. 327".

25. City of Hamilton. "An Assessment of Street Dust and Other Sources of Airborne Particulate Matter in Hamilton, Ontario", March, 1982.

26. Ecologistics Ltd. "Environmentally Sensitive Areas Study - Hamilton Region Conservation Authority", 1976.

27. DeLCan. "Floodplain Analyis - Red Hill Creek Valley", March, 1979.

28. DeLCan. "Traffic Analysis of East-West Arterial", June 5, 1980.

29. The Trow Group Ltd. "Geotechnical Investigation Mountain East-West and North-South Corridor Study, Phase 4", May, 1980.

30. The Trow Group Ltd. "Proposed Red Hill Creek Escarpment Crossing", November, 1980.

31. Hall, Breston, Taylor. "Effects of Highway Noise on Residential Property Values", TRB 686, 1978.

32. DeLCan. "Archaeological Survey and Heritage Resource Assessment: East-West and North-South Transportation Corridor", June, 1980.

33. Valcoustics Ltd. "Noise Impact Assessment: Mountain East-West and North-South Transportation Corridor", October, 1980.

APPENDIX B

DESCRIPTION OF TRAVEL DEMAND FORECASTING PROCEDURE

The model was developed during the Regional Official Plan process in order to evaluate the transportation impacts of future land use development and possible modifications or additions to the Regional Transportation System such as the proposed facility.

THE MODEL

The purpose of the Regional Travel Forecast Model is to forecast future travel demands on the transportation systems in the Region resulting from future development. The model requires input of measures of future development and outputs forecasts of traffic flows on the road and transit systems in the Region by specific routes or by corridors representing an aggregation of routes.

The Model is an analytical tool based on accepted research and practise by Transportation Planners throughout North America. It utilizes computer programs, developed and supplied by the Provincial Ministry of Transportation and Communications, which have been calibrated to represent conditions in Hamilton-Wentworth as measured in special surveys conducted in the Region.

The model is based on the accepted theories that:

a) the amount of traffic on the transportation systems is a function of the amount of development and the interaction between development.

b) the share of traffic on either the road system or the transit system is a function of the comparable costs of utilizing the systems both in terms of money and time and the intensity of land use of both ends of the travel; and

c) the choice of a specific route on a transportation system is based on minimizing the travel time and travel costs.

All of these theories are expressed as mathematical functions in the computer simulations of the transportation systems. The exact mathematical variables that are used in the simulation are dependent on the characteristics of the road and transit systems and the travel characteristics of the population in Hamilton-Wentworth. Defining the magnitude of the mathematical variables that best describe conditions in Hamilton-Wentworth is referred to as calibrating the model.

MODEL CALIBRATION

To calibrate the model, it was necessary to have measures of conditions in Hamilton-Wentworth. This information was obtained from a number of sources.

The nature and operating condition of the transportation systems were obtained from the Regional Engineering Department, the City of Hamilton Traffic Department and the Hamilton Street Railway. The information on the road system included data for major road links such as length, number of lanes, capacity, and peak hour operating speeds. The information on the transit system included length, headway, average travel speed, and average peak hour patronage for each bus route. This information was obtained for the year the model was calibrated and has been updated periodically since.

The main source of information on the travel behaviour of individuals and households in Hamilton-Wentworth was a Travel Characteristics Survey conducted in 1974. This consisted of a telephone interview of one percent of all households in Hamilton-Wentworth and Burlington. It collected key data on the characteristics of the household, the individuals that formed the households, and the travel made by those individuals on a typical day. The information from the survey was summarized to obtain measures of trip generation for individuals, households and labour force and the trip length

distribution for different trip purposes. Also surveyed were the variation in choice between auto and transit mode relative to trip orientation, the characteristics of the traveller and the differences in travel time of the two modes.

The survey sample was tested to be sure it accurately represented the Hamilton-Wentworth population by comparing data summaries on household and population characteristics from the survey to similar summaries from the 1971 Canada Census data and testing for accuracy of fit.

The data from the 1974 Travel Characteristics Survey was supplemented from two other sources. Additional data on transit useage and the choice between auto and transit mode was obtained from an onboard Bus Passenger Survey conducted in November, 1972 by De Leuw Cather Limited Consultants for the Hamilton Street Railway. That survey provided an accurate measure of the number of persons utilizing transit between different geographic areas. Data on traffic travelling into, out of, or through the Region was obtained from a roadside origin-destination survey conducted by the Region in 1976. That survey was used as the basis of calibrating a model to represent external traffic flows in the Region.

MODEL VALIDATION

Before being used to forecast future travel conditions, the accuracy of the model was checked by comparing a simulation of base year conditions against actual measures of traffic conditions in the base year. The base year used was 1971 because of the accuracy of available data on land use measures from the Census and a comprehensive employment survey done that year. The checks included a comparison of measures of traffic flows on road and transit systems, by major corridors, between the simulation and observed counts. 1971 traffic count data was provided by the Hamilton Street Railway, the City of Hamilton Traffic Department and the Provincial Ministry of Transportation and Communications. Additional checks were done by comparing the simulation of trips between different geographic areas with similar data collected in the 1971 Census Place of Work - Place of Residence survey.

Further validation checks are made by periodically monitoring traffic flows by major corridor. This monitoring program summarizes traffic data collected in surveys such as the 1981 Traffic Cordon Survey, and plots changes in traffic over time. Trends in traffic are compared with the model projections for the area to check if they are consistent.

APPENDIX C
COMMITTEE MEMBERSHIP

STUDY TEAM

H.O. Schweinbenz Chairman	-	Regional Engineering Department
G.S. Aston Secretary	-	Regional Engineering Department
J. Barr	-	Regional Planning Department
B. Vanderbrug	-	Regional Conservation Authority
F.A. Cook	-	General Manager, Hamilton Street Railway
N. Shamrock	-	Hamilton Street Railway
A. Gretzinger	-	Town of Stoney Creek
R. Morrow	-	Town of Ancester
E. Havelka	-	City Engineering Department
M.F. Main Vice-Chairman	-	City Traffic Department
A. Georgieff	-	City Planning Department
E. Novak	-	City Recreation Department
C. Louis	-	Niagara Escarpment Commission
B. Khojajian	-	Ministry of Transportation and Communications
K. Pask	-	Ministry of Transportation and Communications
C. Willis	-	Ministry of Transportation and Communications
J. Marcolin	-	Municipal Engineer - Ministry of Transportation and Communications
D. Turvey	-	DeLCan (Consultant)
S.I. Donat	-	DeLCan (Consultant)

In addition to above, the Study Team included occasional representatives of the IBI Group (Subconsultant) and Ecologistics Limited (Environmental Subconsultant).

STEERING COMMITTEE

A.H. Jones	-	Regional Chairman
R. Wheeler Chairman	-	Regional Councillor
J.A. MacDonald	-	Mayor - City of Hamilton
H. Gordon Dean	-	Mayor - Town of Stoney Creek
D. Weylie	-	Mayor - Township of Glanbrook
A. Sloat	-	Mayor - Town of Ancaster
J.Stowe	-	Regional Councillor
D. Gray	-	Regional Councillor
M. Taylor	-	Regional Councillor
F. Lombardo	-	Regional Councillor
W. McCulloch	-	Regional Councillor
C.T.C. Armstrong	-	Regional Coordinator
R.G. Leach	-	Commissioner, Regional Engineering Department
D. Lychak	-	Commissioner, Regional Planning and Development Department
T.G. Smith	-	Regional Director, MTC
R.J. Desjardins	-	Traffic Commissioner, City of Hamilton
C. Robertson	-	District Engineer, MTC
W.L. Phillips	-	City Engineer, City of Hamilton
H.O. Schweinbenz	-	Chairman, Study Team

APPENDIX D
PRE-SUBMISSION CONSULTATION PROCESS AND DOCUMENTATION

DESCRIPTION OF PRE-SUBMISSION CONSULTATION PROCESS

Consistent with the "one-stage" submission process, various agencies were contacted during the preparation of the draft document. Where required, the format and content of the document were revised in accordance with the comments received.

During July 1980, prior to the preparation of the draft Environmental Assessment Document, meetings were held with various provincial ministries to discuss the specific requirements of the ministry with regard to the Environmental Assessment Act, 1975. The following ministries were contacted.

Agency	Representative	Date of Contact
• Ministry of Industry and Tourism	K.C. Mesure W. Hunter	July 14, 1980
• Ministry of Culture and Recreation	J. Weiler D. McLeod	July 16, 1980
• Ministry of Agriculture and Food	D. Gallagher	July 16, 1980
• Ministry of Housing	R. Kennedy	July 17, 1980
• Ministry of Environment	R. Hodgins	July 17, 1980
• Ministry of Treasury and Economics	C. Lonero	July 29, 1980
• Ministry of Energy	D. Saxe	July 29, 1980

In addition, a meeting was held with the local representative of the Ministry of Agriculture and Food, Mr. W.D. Keys, on September 22, 1980.

In May of 1981, the draft Environmental Assessment Document was forwarded to the agencies listed in Table D-1 for their review and comment. Those agencies from which written comments were received are noted with an asterisk.

As a result of the concerns raised by particular agencies, a field trip was organized in September 1981 to provide the reviewers with further insight regarding the project. On February 10, 1982, a further meeting was held at the Ministry of Environment offices. The purpose was to assist the Region and its Consultants to respond to the comments and requirements of the reviewing agencies.

DOCUMENTATION OF COMMENTS AND RESPONSE

The comments received from agencies are highlighted and cross-referenced to the response provided in this submission.

Ministry of Industry and Tourism

In correspondence dated May 25, 1981 from Dr. A. Betanski, Senior Policy Coordinator, the Ministry was supportive of the undertaking. The following is a direct quotation:

> "In our view, the present traffic congestion in the area of study creates problems for industrial expansion. The construction of the proposed East-West and North-South Traffic Corridors should help alleviate these problems.
>
> "We have not found any provisions in the Document that would be contrary to the policies of this Ministry."

Table D-1

DRAFT ENVIRONMENTAL ASSESSMENT DOCUMENT MAILING LIST

Mr. Zigmund Betanski*
Policy and Priorities Division
Ministry of Industry and Tourism

Mr. Peter Burns, Advisor
Ministry of Inter-Governmental Affairs
Local Government Organization Branch
Functions Policy Section

Mr. V.W. Rudik*
Assistant Director
Environmental Approvals Branch
Ministry of the Environment

Hamilton Region Conservation Authority*
Attention: Mr. B.W. Vanderburg

Mrs. Carol Lonero*
Economic Development Branch
Ministry of Treasury and Economics

Mr. D.E. McFarlane
Manager, Environmental Office
Ministry of Transportation and Communications
Attention: Mr. Harvey McNeely

Mr. G.H. Mills, Director
West-Central Region
Ministry of the Environment
Attention: Mr. Ray Stewart

Director
Air Resources Branch
Ministry of the Environment
Attention: Dr. John Hewings

Mr. Ray Riley, Director
Land Use Coordination Branch
Ministry of Natural Resources

MNR Central Region
Attention: Mr. R.M. Dixon, Director

MNR Cambridge District Office*
Attention: Mr. D. Routly

Mr. John Manuel
Noise Pollution Control Section
Ministry of the Environment
Attention: Mr. Hazim Gidamy
Mr. Les Kende

Mr. Brian Ward, Supervisor*
Land Use Coordination and
Special Studies Section
Ministry of the Environment

Mr. R.B. Apted, Director
Historical Planning and
Research Branch
Ministry of Culture and Recreation
Attention: Mr. John Weiler

Mr. Ivo McMullin, Chairman*
Niagara Escarpment Commission

Mr. S.E. Salbach
Water Resources Branch
Ministry of the Environment

Ministry of Natural Resources

In correspondence dated June 6, 1981 from Mr. D. Routley, Lands/Minerals Supervisor, Cambridge District, the Ministry did not indicate objection to the proposed undertaking. The following is a direct quotation.

> "In this regard, we have determined that the proposal will not seriously impact on any of our resource priorities. The Document thoroughly identifies the environmental consequences of the project on the Red Hill Creek Valley. Our Forestry and Wildlife Sections are satisfied that the proposed mitigative measures are appropriate for the area in question."

The Ministry of Natural Resources requested consideration be given to the following during the detailed design stage:

- evaluation of the impact on Site No. 59 - Vinemount Shale Exposure;
- the use of existing aggregate resources; and
- rehabilitation of Van Wagner's Marsh.

Ministry of Culture and Recreation

In correspondence received from R.B. Apted, Director of Historical Planning and Research Branch, the Ministry requested further investigation and description of the heritage component of the environment be undertaken. This request was again stated in correspondence dated February 17, 1982 from Mr. D.J. Cuming, Heritage Planner. The following is a quotation from the letter:

> "While the archaeological component was generally satisfactory, there remained deficiencies with respect to the analysis of the built enivronment."

Based on these comments, further study was carried out by the proponent to expand on the history of the study area and an analysis of historical buildings, including their possible significance and mitigating measures. The results of the further investigation undertaken to respond to the Ministry's request is given in:

- Section 4.1.2 - Heritage Resources
- Section 6.2.9 - Scenic Resources, Recreational Resources and Historic Values

Niagara Escarpment Commission

In correspondence dated June 15, 1981 from Mr. C Louis, Manager, Plans Preparation, the following issues were raised:

- Adjustment of Document to reflect effect of revised population forecasts;
- Status of Recreation Master Plan Document;
- Future Vegetation and Wildlife Patterns; and
- Possible effects on Floodplain and Erosion Hazard in Red Hill Creek Valley due to Urbanization.

The impact of the revised population forecasts have been reflected in Section 3 - Forecast of Transportation Demand. The intent of the Recreation Master Plan was to demonstrate the effect of constructing a roadway on the recreation potential of the Red Hill Creek Valley. There is no commitment on the part of the proponent to implement the Plan in association with the roadway construction.

The natural environment impact analysis deals at length with the potential effects on wildlife, vegetation, water quality, hydrology, groundwater, and scenic resources. The analysis treated the natural environment as a interdependent ecosystem and thereby discussed impacts on existing vegetation and wildlife, but also the potential effects on future processes.

All drainage structures and embankment protection included in the proposal assumed stormwater flows under full urbanization above the Escarpment. These drainage structures will ensure the stabilization of the Creek bed and protect against lateral movement. In effect, a "worst case" situation has been assumed to assess impacts and identify mitigative measures. No assumption regarding possible reduction of peak flows has been assumed due to the introduction of stormwater management techniques.

Ministry of the Environment
Environmental Approvals Branch

An extensive response was received from the MOE dealing with the content and format of the document. The major comments are summarized below:

- Provision of a greater amount of information on travel demand, roadway capacity, goods movement, truck traffic and travel demand forecasting procedure. Section 3 - Forecast of Travel Demand provides a thorough discussion of the transportation component. Appendix B provides an outline of the forecasting procedure.

- Provision of an expansion of the description of the planning alternatives, including the "No-Go", "Minor" road improvement alternative, transit and other road projects. Section 5 - Alternatives and Evaluation has been expanded to respond to these comments. Greater detail has been provided regarding the selection of evaluation factors and the evaluation process.

- The major concern expressed was the limited discussions of the scope of the problem. Section 2 - Statement of Rationale has been developed to respond to this concern. It includes a discussion of the purpose and the current transportation-related issues.

Several specific comments were provided, and the format and information given in this final submissions have been revised where appropriate to satisfy these remarks.

Ministry of Treasury and Economics

In correspondence dated June 24, 1981 from Carol E. Lonero, the Ministry was of the opinion that the discussion of the economic development issues was severely limited. In response, the following areas have been expanded or added:

- Underlying relationships between accessibility and industrial location decision making (pp. 2-2).
- Description of past development predicated on major road improvements (pp. 2-4).
- Implications of transportation improvements to energy conservation and safety (pp. 6-43).
- Provision of available data on truck origin-destination information (pp. 3-12).
- Relative accessibility to employment locations under the evaluation of the alternatives (pp. 5-34).
- The impact and relationship of the undertaking to other road projects (pp. 5-3).

Ministry of the Environment
Land Use Coordination and Special Studies Section

In correspondence received from Mr. Ian Veitch, Environmental Planner, the following general comments were provided.

- "Greater information is required regarding the transit and no-action options". This is similar to the comments from other reviewers. Section 3 - Forecast of Transportation Demand, and Section 5.1 - Selection of Appropriate Planning Alternative provides an expanded discussion of the transit and no-action alternatives.

- "Greater detail regarding travel demand projections for the critical screenlines and provide origin-destination data." This information is given in Section 3 - Forecast of Transportation Demand.

- "Confusion exists regarding the estimated costs for the alternatives." This is a result of the extended duration of the project. In Phase 2, 1979 unit costs were used to estimate construction costs without estimates for property costs. In Phase 3, as greater detail was developed, 1979 unit costs together with property cost estimates. In Phase 4, 1980 unit costs were used for the selected alternative. In this final submission, the cost of the selected alternative was updated using 1982 costs. To clarify, the costs for Alternative 2 are listed below as the appear in the report.

Section 5.4.1	-	Preliminary Screening 1978 Construction Cost without Property	$59.8 M
Section 5.5.2	-	Evaluation of Short-Listed Major Roadway Expansion	$80.0 M

The estimate of $80.0 M (1978) given is comprised of:

Roadway Construction:	$48.1 M
Structures:	$19.8 M
Property Acquisition:	$12.1 M
Total	$80.0 M

In the Phase 4 functional planning, 1980 unit costs were used. The total estimated cost was as follows:

Roadway Construction:	$ 55,680,000.
Structures:	$ 30,840,000.
Property Acquisition:	$ 15,346,000.
Total	$101,866,000.

The above cost estimate was provided in the draft Environmental Assessment document reviewed during the pre-submission process. The final submission incorporates a further update of the cost estimates based on 1982 unit costs. The corresponding 1982 estimate is summarized below:

Roadway Construction:	$ 70,690,000.
Structures:	$ 36,375,000.
Property Acquisition:	$ 16,880,000.
Total	$123,915,000.

The increase in construction cost is principally the result of inflation and, to a limited extent, due to added costs due to refinements as more detailed information was developed. Given an annual average inflation rate of 10 percent, costs will escalate 60 percent over a 4-year period.

- "Provide a comparison of the alternatives to the undertaking with the major road expansion alternatives." This comparison is provided in Table 5.1, pp. 5-13.

In addition to the above general comments, the following specific suggestions were offered:

- "Identify coordination with other transportation projects." This is provided in Section 5.1.1.

- "Why can't traffic use Highway 403?" Highway 403 has been incorporated as an integral part of the urban road system. The forecast demand exceeds the capacity of this facility while a deficiency exists along the central and east screenlines. In summary, the capability of Highway 403 to accommodate internal traffic has been recognized in projecting the 2001 roadway deficiencies.

- "It is unclear if additional traffic spillage onto local streets during construction is adequately considered". The staging of construction is discussed in Section 6.1.13. The following points are emphasized:

(i) The intent is to carry out construction on a continuous basis over a 10-year period beginning in 1985.

(ii) The impact on adjacent neighbourhoods during construction is forecast to be minimal as the local circulation patterns will be maintained until each major segment is opened. The terminal points of each stage have been selected at the major arterials to ensure no local streets are using during an interim period.

- "The location of population and employment growth should be indicated". These data are provided in Figure 4 - Location of Population and Employment growth.

Hamilton Region Conservation Authority

The Conservation Authority is on record as being opposed to the freeway facility in its proposed location. It intends to present its opposition directly to the Environmental Assessment Board.

APPENDIX E
LISTING OF CONSULTANTS

Consultant	Area of Invesigation
DeLCan, De Leuw Cather, Canada Ltd. Consulting Engineers and Planners	• prime Consultant • project management • roadway functional planning • traffic analysis • stormwater management impacts • historic and heritage resources • archaeological survey
IBI Group	• travel demand forecasting and analysis
Ecologistics Limited	• natural environment impact analysis • recreation master planning investigation
Robert Lehman Planning Consultants Ltd.	• social environment impacts
Valcoustics Ltd.	• noise impact analysis
The Trow Group Limited	• soils and geotechnical invesigations